CANADA FOUNDATION FOR INNOVATION

NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL

CANADIAN INSTITUTES OF HEALTH RESEARCH

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NETWORKS OF CENTRES OF EXCELLENCE

CANADA RESEARCH CHAIRS

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EARLY RESEARCHER AWARD PROGRAM/ PREMIER'S RESEARCH EXCELLENCE AWARDS

ONTARIO CENTRES OF EXCELLENCE

A Sampling of 2005-06

Success Stories *of*

PREPARED BY THE ONTARIO COUNCIL ON UNIVERSITY RESEARCH

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Research Success Stories

July 2006

Dear Colleagues,

Welcome to *Research Success Stories 2005-06*. On behalf of the Ontario Council on University Research, I am pleased to present our newest stories of research innovation and discovery.

It's been an exciting year for Ontario's university research community. Once again, our researchers have reached new frontiers in improving Ontario's competitiveness, strengthening our culture, improving health care and advancing technology.

This edition of *Research Success Stories* celebrates key members of the research team—graduate students. Wherever possible, their important contribution to each university's research goals is highlighted in every story.

Hands-on research provides graduate students with a unique learning experience that extends well beyond the lecture hall. Through research, they develop workplace insight and competencies, gain team-building skills, learn leading-edge research techniques and earn the opportunity to publish their findings in leading professional journals.

Ontario universities are grateful for the financial resources that have allowed our researchers and graduate students to demonstrate their expertise and commitment to scholarly enquiry. In particular we thank the research and scholarship funding programs of the federal and provincial governments, and the funding support shown by agencies, foundations and private sector partners.

I am confident you will enjoy these stories, as they showcase the vibrant synergy between researcher, graduate student and funding partner.

Yours sincerely,

Feridun Hamdullahpur
Chair, Ontario Council on University Research

Key Federal and Provincial Research Funding Programs

In addition to the programs of three federal research granting councils—the Natural Sciences and Engineering Research Council (NSERC), the Canadian Institutes of Health Research (CIHR) and the Social Sciences and Humanities Research Council (SSHRC), federal programs frequently cited in Success Stories include:

Canada Foundation for Innovation (CFI): Established in 1997, the CFI provides support on a competitive basis for the development of research infrastructure at universities, hospitals, research institutes and colleges. The CFI supports 40% of project costs and recipients must raise the remaining 60% from other sources, including provincial programs and the private sector. For Ontario projects, the Ontario Research Fund—Research Infrastructure program matches the CFI contribution.
Website: *www.innovation.ca*

Canada Research Chairs (CRC) Program: This program was introduced in 2000 to support the establishment of 2,000 Chairs in Canadian universities by 2005. Tier I Chairs are awarded to experienced star researchers who will receive $200,000 annually for seven years, renewable for any number of terms. Tier II Chairs are awarded to exceptional emerging researchers, who will receive $100,000 annually for five years, renewable once.
Website: *www.chairs.gc.ca*

Networks of Centres of Excellence (NCE) Program: NCEs, which are funded through the budgets of the three federal granting councils, foster research partnerships among universities, industry and government to develop the economy and improve the quality of life of Canadians. Currently, there are 24 networks, 11 of them led by Ontario institutions.
Website: *www.nce.gc.ca*

Ontario Government programs often cited in the stories include:

Ontario Research Fund—Research Excellence (ORF-RE) Program: The ORF-RE program was established in 2004 and supports leading-edge research, develops research talent, encourages partnerships between institutions and business, and emphasizes youth outreach/mentorship activities. The program contributes one-third of the operating costs (direct and indirect), with a third matched by the private sector and a third by the institution.
Website: *http://www.mri.gov.on.ca/english/programs/ResearchExcellence.asp*

The ORF-RE has replaced funding previously provided through the Ontario Research and Development Challenge Fund (ORDCF).

Ontario Research Fund—Research Infrastructure (ORF-RI) Program: The ORF-RI program was established in 2005 to support the modernization, development and/or acquirement of new research infrastructure. It is the key vehicle for matching CFI's contribution to Ontario projects under the Leading Edge Fund, the New Initiatives Fund, the Leaders Opportunity Fund or the CRC Infrastructure Fund. The program generally supports 40% of total eligible costs.
Website: *http://www.mri.gov.on.ca/english/programs/orf/ri/program.asp*

The ORF-RI has replaced funding previously provided through the Ontario Innovation Trust (OIT).

Ontario Research Commercialization Program (ORCP): The ORCP is intended to increase Ontario's innovation capacity by supporting innovative projects that work with private sector expertise and resources, build links between institutions and the private sector, bridge the gap between research discovery and market-ready innovation and contribute to an entrepreneurial culture.
Website: *http://www.mri.gov.on.ca/english/programs/ORC-ProgramGuidelines.asp*

Early Researcher Award (ERA) Program: The ERAs provide support for promising young researchers to hire graduate students and post-doctoral students for their research programs. Recipients are selected competitively and usually are awarded about $150,000. Two-thirds of this funding, or up to $100,000, is provided by the Ontario government, while the university provides the remaining $50,000 through funds raised from the private sector.
Website: *http://www.mri.gov.on.ca/english/programs/era/program.asp*

The ERA program replaces funding previously awarded through the Premier's Research Excellence Award (PREA) program.

Ontario Centres of Excellence (OCE) Program: The OCEs were founded in 1987 and consist of five Centres: a Centre for Energy; a Centre for Communications and Information Technology; a Centre for Earth and Environmental Technologies; a Centre for Materials and Manufacturing and a Centre for Photonics. Collectively, these Centres help to bridge the gap between industry and university research by bringing research discoveries to the marketplace in the form of new products and services.
Website: *http://www.oce-ontario.org/*

Ontario universities also acknowledge the contribution of the federal Indirect Costs program and the Ontario Research Performance Fund to the indirect costs of the research supported by these programs.

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Brock University

Rewards of Mentoring

David Gabriel is passionate about mentoring graduate students. A professor and researcher in Brock University's Department of Physical Education and Kinesiology, Prof. Gabriel's advanced research relies increasingly on graduate students to conduct a broad range of scientific investigations.

Participating in projects funded by the **Natural Sciences and Engineering Research Council**, Prof. Gabriel's students learn to take an idea, work out the details, decide how to perform various tasks and solve problems along the way. Each contributes something unique, according to his or her intellectual strengths. In turn, Prof. Gabriel directs his students in experimental techniques, lab set-up and ethical behaviour.

Graduate students Anita Christie, Kristina Calder and Steven Lester are involved in analysis methods for surface electromyography—a test that assesses the health of the muscles and the nerves controlling the muscles. Anita reported on a new measure to monitor motoneuron excitability; Kristina conducted research on the reliability of evoked potentials from the biceps muscle; and Steven's project quantified spike activity in the electromyogram.

Prof. Gabriel says, "Students determine the reputation of the lab and, depending on the quality of the lab's work, doors are opened or closed." His students exemplify this—Anita and Kristina have chosen to pursue their PhDs, publish their work, gain exposure through conference presentations and work at other labs. Steven is enrolled in chiropractic college, an area related to his master's research.

Prof. Gabriel believes he has also learned from his students. "Students have young, fresh minds with new perspectives—their questions teach me what I don't know."

▼ Prof. David Gabriel stands behind his graduate students (left to right): Kristina Calder, Gary Kamen, Anita Christie, Greg Inglis, Steven Lester and Sean Lenhart.

funding profile

◗ Natural Sciences and Engineering Research Council	$80,000
◗ Canada Foundation for Innovation	$146,342
◗ Ontario Innovation Trust	$146,342

Brock University

Fostering Student and Faculty Partnerships

When part-time Brock University MBA students Gail Riihimaki and Carrie Kelly received funding from the **Natural Sciences and Engineering Research Council (NSERC)** to pursue their independent business research projects, they turned to Prof. Kenneth Klassen, with Brock's Department of Finance, Operations and Information Systems, for his expertise on demand and capacity management in services. Recognizing the high quality of their research proposals, he readily agreed to supervise their projects.

"It's rewarding to be involved with high-quality, student-driven research," he says.

Gail chose to focus her research with her employer, the Niagara Community Care Access Centre. A key community resource, the Centre co-ordinates home care for the Niagara region. Using forecasting models, she helped the Centre develop monthly and yearly service budgets, an important step in controlling deficits and surpluses. Gail plans to submit her research findings to the *International Journal of Production and Operations Management*.

Carrie, a financial officer in Brock's Office of Research Services (ORS) also looked to her office for her research focus: she decided to measure the efficiency and effectiveness of her workplace. She developed an online needs assessment and satisfaction survey for faculty to determine the level of support they need throughout the research funding process and whether current services meet these needs. Carrie plans to submit her findings for journal publication as well.

Prof. Klassen has also supervised two graduate students in their NSERC-funded initiative to examine whether self-service technologies—such as ATM machines and pay-at-the-pump options—affect a company's stock price. They plan to publish the results of their research in the future.

Carrie Kelly and her research supervisor Prof. Kenneth Klassen.

funding profile

Natural Sciences and Engineering Research Council	$85,000

Brock University

Heather Chalmers: From Student and Mentor to Brock Professor

When she became involved in the Youth Lifestyle Choices-Community University Research Alliance (YLC-CURA) project in 1999, Heather Chalmers was a part-time Brock University graduate student working at the Centre for Addiction and Mental Health (CAMH). Instrumental in preparing CURA's initial letter of intent, Chalmers was a lead grant-writer for the agency's original three-year application and subsequent two-year completion grant.

In 2001, Chalmers took a leave of absence from CAMH to pursue doctoral studies at Brock. Here, she mentored and supervised several professional staff and masters students working with the YLC-CURA. "Students and staff were hired as research assistants and trained in research methodology," says Chalmers. "In total, over 90 students were recruited to assist with research across the Niagara peninsula."

Under her direction, YLC-CURA students and staff taught co-operating community agencies how to evaluate their own programs and services without outside assistance—a valuable transfer of knowledge and skills from Brock's research community to key community organizations.

As a doctoral student, Chalmers also co-authored and co-presented a number of papers at conferences with students she had mentored. Since then, several of these students have gone on to master's and doctoral studies.

Since receiving her PhD in psychology in 2004, Prof. Chalmers continues to work with students examining the larger issue of risk-taking and resiliency. Noting that her specific research focuses on adolescent gambling, she states, "Undergraduate and graduate students are an integral part of my research program—their assistance is invaluable to me."

Graduate students are a key component of Prof. Heather Chalmers' research into adolescent gambling.

funding profile

Social Sciences and Humanities Research Council	$1 million
Human Resources and Skills Development Canada	$270,460
Ontario Trillium Foundation	$157,000

Brock University

Dr. Coral Mitchell (left), with PhD candidate Nancy Fenton.

Dr. Mitchell also supervises the doctoral research of Nancy Fenton and Rahul Kumar. Nancy's research explores the role of tension in educational change and school improvement. This research focus evolved from her work with one of the schools from Dr. Mitchell's study. Nancy plans to defend her thesis later this year.

Rahul's master's research grew out of a series of articles on ethics and educational leadership that he published with Dr. Mitchell.

Both Nancy and Rahul are successfully published researchers. Once relying on Dr. Mitchell's literature, today they challenge her interpretations. "Their work raises new questions about the frameworks that I developed with my research," says Dr. Mitchell.

Learning to Improve Education

Coral Mitchell, Chair of Brock University's Department of Graduate and Undergraduate Studies in Education, examines schools as learning communities.

Her latest research project, a three-year collaborative initiative with Dr. Larry Sackney of the University of Saskatchewan, explores the characteristics of high-performing schools.

Funded by the **Social Sciences and Humanities Research Council**, Dr. Mitchell's research includes broad-based surveys, interviews and on-site observations with a variety of educators, parents and students. She has studied 69 Ontario schools throughout her investigation, ranging from elementary to secondary schools. Two of these schools became Lighthouse Learning Community Schools—institutions that demonstrate best practices for school improvement. Currently, Dr. Mitchell is organizing her research findings for the *Journal of School Leadership*.

funding profile

- **Social Sciences and Humanities Research Council**
  - **Principal Investigator: Prof. Larry Sackney, University of Saskatchewan**
  - **Subgrant to Prof. Coral Mitchell** **$62,250**

Brock University

Acting Out

David Fancy, a professor in Brock's Department of Dramatic Arts, is involved in several areas of scholarly research and student mentorship. With years of experience in training theatre artists, Dr. Fancy sees theatre as a means of progressive social engagement.

His work in community-based applied theatre has involved professional actors, community service agencies, social workers and drama therapists. Students play a major role in this research. One of Dr. Fancy's projects brought together multicultural artists, the community and students, with parolees and recovering addicts.

"There is a profound change in each individual who participates in these processes," notes Dr. Fancy. "These processes feed into community renewal, reinvigorating ideas around citizenship."

Currently, six of Dr. Fancy's students are participating in a community-health, theatre project for the Breast Cancer Research Education Fund.

One of his former students worked for the United Nations in Africa, after completing her PhD in Theatre for Social Change at Queen Mary University in London, England. According to Dr. Fancy, "She will likely teach at a university and use it as a means to engage and educate local populations and communities on issues of economic opportunity, agricultural initiatives and health."

Bringing together professional actors and community organizations, Dr. David Fancy sees theatre as a means of progressive social engagement.

funding profile

Human Resources and Skills Development Canada	$87,000
Heritage Canada	$160,000

Brock University

Chemistry Goes Green

In 2003, Tomas Hudlicky arrived at Brock University with two postdoctoral researchers and two graduate students. Today, this chemistry professor and **Canada Research Chair** mentors 15 co-workers including four postdoctoral researchers, six graduate students and five undergraduates.

Dr. Hudlicky is focusing his research on "green chemistry"—the creation of new drugs in an environmentally responsible way. This approach combines traditional synthetic techniques with biocatalysis and electrochemistry. A number of his students are involved in the synthesis of biologically active natural products.

Students describe Dr. Hudlicky as an active researcher who, while running his own experiments, also provides 30 years of hands-on experience to students in the graduate program.

"Student involvement is very important and beneficial to the advancement of my research," says Dr. Hudlicky. "None of my work would be possible without the dedicated effort of students at varying levels of their education."

A diverse group of senior students are also teaching other students. As supervisors, they learn team and project management—key requirements in industry.

Most of his students have co-authored and published papers. Some also presented at the 11th Biennial Symposium on the Latest Trends in Organic Synthesis which was held in Canada for the first time in 2004.

More than 270 students have passed through Dr. Hudlicky's program; many have gone on to launch successful careers in both academia and industry.

Back row (left to right): Solomon Fixon-Owoo, Dr. Michael Moer, Brad Sullivan, Jon Collins, Hannes Leisch, Breno Coelho, Dr. Tomas Hudlicky
Middle row (left to right): Kevin Finn, Dr. Scott Banfield, Xuetong Sun
Seated (left to right): Dr. Josie Reed, Lena Rochon

funding profile

Canada Research Chair	$1.4 million
Natural Sciences and Engineering Research Council	$165,000
Noramco Inc.	$124,000
Dupont	$14,632
TDC Research Inc.	$45,000

Carleton
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A Little Light and a Lot of Experience

The technology might be small, but the applications are huge.

Photonics technology, the use of light to store and transfer information, isn't just reserved for communications. It also has applications in monitoring the environment, or even assisting with the diagnosis of cancer by identifying abnormal cells.

Now, with the opening of the Canadian Photonics Fabrication Centre (CPFC), Carleton University PhD students have the opportunity to acquire hands-on experience in this ever-evolving, innovative industry.

"We can learn the complete package from simulation and design to fabrication," says grad student Kuan Pei Yap. "There are very few universities where you can get experience actually making things." In fact, there are so few universities with this kind of training for graduate students that Kuan came all the way from Singapore to pursue his PhD in electronics at Carleton.

Carleton is working in partnership with the National Research Council at the CPFC in the simulation, design, fabrication and testing of optoelectronic devices involved in photonics. Primarily, Carleton students are involved with the design and testing of devices.

"Before graduate studies, it was just books," says Winnie Ye, another Carleton PhD student working at the CPFC. "All this experience provides training."

That's another goal of the partnership, says Sylvain Charbonneau, Director of Applications Technologies at the CPFC. While students gain rare, practical, hands-on experience, their involvement in research and design is also of great value to industry. "It's part of the training of highly qualified professionals," says Dr. Charbonneau.

Sandy Ng, Kuan Pei Yap and Winnie Ye, PhD students in electronics, with Prof. Garry Tarr (centre).

Carleton
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Historic Research of Note

A professional singer for nearly 25 years, Kristina Guiguet began to find the 19th-century music she was performing not only entertaining but also educational.

"I started to look into 19th-century gender issues in music and why it was that way," she says. This research led to broader questions, particularly the connection between music in people's public and private lives in the 1800s.

A doctoral student in history, Kristina's research focuses on English-speaking Canada between 1840 and 1860, the various types of music performed in different circles of society, and what the notes on the page reveal about life at the time.

This type of research could only be possible at a school with a strong interdisciplinary program, she says.

The bulk of her research will involve interpreting old documents in new ways. For example, old concert programs are like short storybooks that can offer great insight into the political issues of the day. Both song choice and even the order in which they were performed can offer clues into historic societal values and views.

Kristina will also compare 19th century Canadian, American and British musical performance to identify any uniquely Canadian features.

Kristina Guiguet, a PhD student in history, is focusing her research on 19th century music and the insight it provides into the society of its time.

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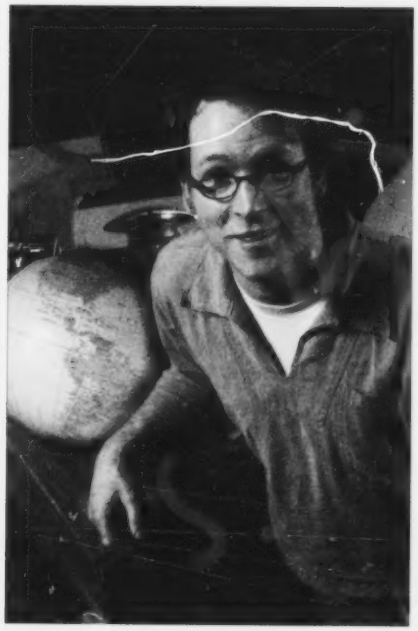

Robert Winger, a PhD student in literature and cultural mediations, is examining travel and tourism trends.

Around the World in 80 Pages

Rob Winger, a PhD student in literature and cultural mediations at Carleton University is focusing his research on the newest trend in travel—anti-tourism. This recent travel fad seeks so-called authentic travel experiences in countries increasingly influenced by Western tradition.

He will gather data by reading between the lines of literary travel books such as *The Beach*, to see what they reveal about travel trends. In *The Beach*, an American tourist takes a "freestyle" trip to Thailand, hoping to soak in the real culture of a country increasingly inundated with tourism.

In addition to literary travel books, Rob will use tourism theory and his own travel experiences for his research.

In the end, he hopes his research will lead to a more balanced literary travel book of his own, combining personal adventure with cultural sensitivity.

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Doctoral student Chris Eaket believes technology will redefine performance art.

Shakespeare Was Right

"All the world's a stage, And all the men and women merely players."

Doctoral student Chris Eaket takes the Bard's words from *As You Like It* literally. He is focusing his research on spontaneous or alternative forms of theatre performed at locations not usually associated with performance.

The Saskatchewan native is pursuing his PhD in cultural mediations, an interdisciplinary program offered through the Institute for Comparative Studies in Literature, Art and Culture at Carleton University. It is one of the few Canadian institutions to offer a Humanities doctorate combining art and technology—in Chris's case, the use of technology in site-specific art.

Site-specific theatre grew out of street protests, art-as-political statement and '60s-era "happenings"—theatrical events without a set plot. With modern technology such as cell phones, iPods and laptops with GIS/GPS technology, today's para-theatrical is moving beyond the streets.

Focusing on projects that use portable digital devices to create theatre in a range of environments, Chris is interested in how technology is used to change performance, and how performance changes our use of technology. Because such performances do not take place on a stage within a theatre, audiences are no longer observers: they become participants, shaping the content of the performance as the environment and action unfold. Theatre becomes fluid, unpredictable and unique.

"We're moving towards a point, technologically and artistically, where everything is seen as a performance and anyone is capable of producing art," says Chris. "That's an important development because it changes the way we interact with our environment: objects become loaded with meaning, our surroundings are seen as a participatory events and all spaces are significant spaces for someone, somewhere."

The technologies used to create these performances overlap with research in other disciplines. Chris works with the Department of Geography and Environmental Science's cybercartography research unit to explore literal and symbolic perceptions of maps. And Brian Greenspan of the Human Computer Interface Lab is helping him to explore how hypermedia and non-linear narrative forms affect the writing, reading and perception of texts.

Chris's biggest research challenge is keeping pace with new developments in a world where technology has truly allowed all men and women to become players.

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It's All About Image

Statia Elliot, a PhD student and instructor with the Sprott School of Business at Carleton University, has a hot tip for Canadian businesses: Listen to what the world is saying about Canada and you'll learn how to better market Canadian products and tourism.

Last year, Statia, who started her PhD after a career in tourism marketing, began her thesis on a comparative analysis of product-country image and tourism-destination image. Her alliance with Sprott Prof. Nicolas Papadopoulos led her to combine the previously separate studies of product and tourism branding.

"This is the first in-depth, comprehensive analysis attempting to bring the two fields together, to bring the theory of each together so we have a way to know just how country image is the umbrella influencing both product image and travel image," she says.

"It's looking at two [veins] of research," she says, "one on the product [side], one on the tourism side. They have a shared focus—this thing called "country image," which influences consumers' perceptions of products and travel destinations. For example, if you see a "made-in ..." label on a product, how does your knowledge of that country influence your purchasing decision?"

Having lived in South Korea for the past two years, Statia is looking at how South Koreans perceive Canada as both a travel destination and manufacturer.

"My research is asking consumers their perceptions of various countries, but the intent is to be able to come to some conclusion as to what the positive and negative associations are with those countries. [This] would assist exporters and tourism destination marketers," says Statia.

This year's recipient of the Sprott Graduate Scholarship Award, Elliot's new academic career is looking very promising, both for her and for Canadian businesses.

"I'm hoping it will really be able to help Canada to strengthen its position globally," she says of her research. "That's a huge macro goal and statement, but, in some small way, I'm hoping it will contribute."

▼
PhD student Statia Elliot is researching how Canada's image abroad affects product and tourism branding.

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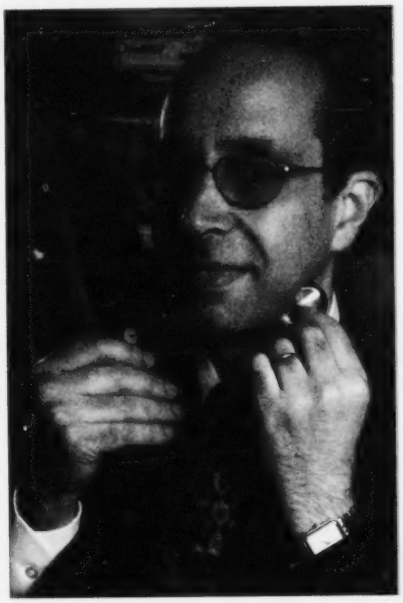


Carleton student researchers, led by Dr. Rufik Goubran, are exploring new ways technology can help to diagnose health problems.

What Does a Heart Attack Smell Like?

While technology has already been applied to many areas of health care, major research projects at Carleton University are proving the high-tech foray has only just begun.

If researchers in the Department of Systems and Computer Engineering have their way, technology will soon serve as the ears and nose of health care—invaluable senses that could safeguard against deadly disease.

PhD candidate Hong Chen continues his cutting-edge work on "electronic nose" technology. The e-nose, which resembles an oversized cell phone, has 32 sensors capable of giving heart patients a diagnosis by "smelling" their breath, says Rafik Goubran, Hong's co-supervisor and department chair.

Hong is using digital signal processing to identify and classify each breath scent. By doing so, he hopes to identify specific scents that could alert doctors to early signs of heart failure.

The purchase of a larger, more sophisticated e-nose, about the size of two or three computers, will develop new algorithms that promise to make the e-nose's abilities more accurate and reliable, and less susceptible to interference from other scents.

Meanwhile, Dr. Goubran is overseeing another promising project conducted by PhD candidate Anita McKee. Her research describes how a sensor-laden stethoscope can monitor different parts of the thorax using high-fidelity microphones. The multiple sensors allow the user to hear several sounds in a single breath, including those that originate from the lung's lobes. These sounds can be analyzed and translated into useful information that could allow doctors to determine if the patient needs medical attention, says Dr. Goubran.

"In the case of an artificial valve, if clotting is forming around the device, the sound changes. This change can alert the doctor to a potential deterioration in the patient before it's too late," he says.

Anita has presented her findings at the Annual International Conference of the Institute of Electrical and Electronics Engineers (IEEE) in Medicine and Biology in San Francisco, the Canadian Medical and Biological Engineering Society conference in Quebec City, and the IEEE Instrumentation and Measurement Technology Conference in Ottawa.

Both PhD candidates began their current research as master's students at Carleton, an advantage that gave both projects great momentum, says Dr. Goubran. Anita and Hong have also benefitted from the invaluable advice of local partners, including the Children's Hospital of Eastern Ontario and the Ottawa Heart Institute.

UNIVERSITY of GUELPH

He Believes in Child's Play

With childhood obesity on the rise, parents, educators and health-care experts are worried that children aren't getting enough exercise. John Dwyer, Professor in the University of Guelph's Family Relations and Applied Nutrition Department, is focusing his research on new ways to get Canadian children outside and onto the playground.

Prof. Dwyer believes Canadian children face a variety of obstacles that inhibit physical activity. Through his research, he intends to identify these barriers and develop programs that will overcome these obstacles and boost Canada's overall fitness levels.

"I have seen first hand the importance of physical activity and nutrition in terms of developing a healthy lifestyle," says Prof. Dwyer. "Diet and exercise form the foundation."

He believes three main barriers keep children and youth from physical activity:

- Intrapersonal barriers, such as gender, income and psychological walls;
- Interpersonal barriers, including the influence of other people; and
- Environmental barriers, such as the cost of programs and access to recreational facilities and equipment.

Ultimately, Prof. Dwyer hopes his research will encourage policy- and decision-makers to design effective programs that will encourage more activity in children and youth.

And to those looking for advice, Prof. Dwyer suggests finding something enjoyable and easy to do. "As committed as I am to physical activity, if I had to go to a gym or a facility, I wouldn't do it," he says. "I just don't have a lot of time. Having my own equipment at home breaks down one of those barriers for me."

Graduate student Talina Chulak is completing her master's degree under Prof. Dwyer and his colleagues. She is researching whether adolescents who are confident in their ability to overcome physical activity barriers go on to participate in physical activity at a higher level.

Prof. John Dwyer is working to increase physical activity levels in Canadian children and youth.

funding profile

JOHN DWYER CO-INVESTIGATOR

◗ Social Sciences and Humanities Research Council	$394,000
◗ Heart and Stroke Foundation of Ontario	$1.1 million

UNIVERSITY of GUELPH

▼ Prof. Georgia Mason is working to improve the welfare of laboratory animals and animals kept by humans.

Looking Out for Animals

Georgia Mason has earned global recognition for her efforts to improve animal welfare in Canada. A **Canada Research Chair** in Food, Animal Behaviour and Welfare, Prof. Mason was one of two people worldwide to receive the new 2005 Charles River Laboratories Excellence in Refinement Award. This award recognized her outstanding commitment to improving the care and housing of laboratory animals.

Prof. Mason is studying the welfare of animals kept by humans, such as food animals and wild animals in zoos. Using laboratory animals as test subjects, she examines their response to stress and how their behaviour changes in captivity. In particular, Prof. Mason is interested in the impact of early maternal care on an animal's response to captivity.

"Worldwide, billions of animals are kept by humans for food, research and other functions—190 million in Canada alone," says Prof. Mason. "We need to assess and improve the welfare of these animals for ethical and legal reasons, and often for practical reasons too."

Her work will also provide answers to questions such as when to clean cages and what enrichment to provide captive animals.

Prof. Mason hopes the benefits of her research will extend to a range of animal species.

funding profile

◗ Canada Research Chair	$500,000
◗ Canada Foundation for Innovation	$123,138
◗ Ontario Research Fund —Research Infrastructure	$123,138

UNIVERSITY of GUELPH

Assessing the Security of Canada's Water

An abundant supply of fresh water is one of Canada's most cherished natural resources. But to keep it safe, resource specialists require the capacity to detect when supplies might be in jeopardy and the ability to respond appropriately.

Edward McBean, Professor in the University of Guelph's School of Engineering, is studying new ways to assess the security of Canada's water—key research that will improve Canada's ability to identify, and respond to, threats to its natural resources.

Prof. McBean is also studying the links among meteorology, water supply, waste-water systems, communications, emergency response and health infrastructure.

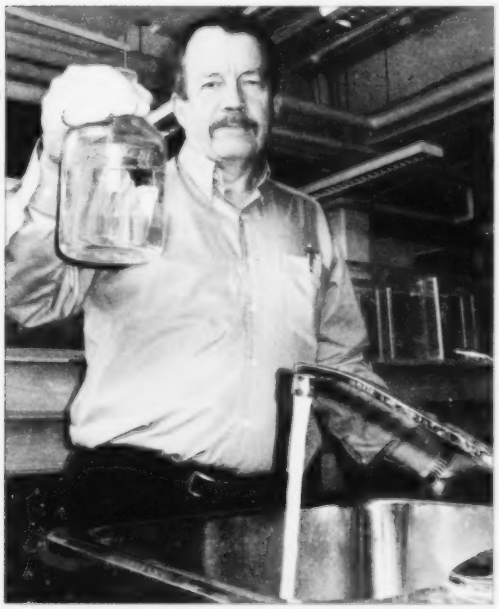
"It's important to understand how one factor or system can affect another," says Prof. McBean. "For example, what if a severe rainstorm wreaks havoc on the water supply and creates health risks for residents. When do we give, and end, a boil-water advisory?"

Through his research, Prof. McBean intends to develop cutting-edge detection methods that will indicate when a water system's safety is in jeopardy, whether from environmental factors, sabotage, water terrorism, threats or vandalism.

Graduate students Jeanne Huang, Khizar Hayat, Khurshid Anwar, Mijin Lee and Cassie Barker are assisting Prof. McBean in his research. They are studying the links among meteorology, water supply, waste-water systems, communications, emergency response and health infrastructure.

The work will provide new insights into the feasibility of water protection and what steps will be most effective in managing the risk. Ultimately, Prof. McBean hopes his findings will lead to the development of models to manage emergencies and to simulate critical infrastructure networks.

▼ Prof. Ed McBean is studying detection methods that will show when a water system's safety is in jeopardy.



funding profile

◗ Canada Research Chair	$1.4 million
◗ Natural Sciences and Engineering Research Council	$188,000
◗ Public Safety and Emergency Preparedness Canada	$128,000
◗ Canada Foundation for Innovation	$125,000
◗ Ontario Innovation Trust	$125,000

UNIVERSITY of GUELPH

The Writing Is On the...Label

Canadian consumers are curious customers. But how much information do they really want—and why?

That's the question Philosophy Prof. David Castle of the University of Guelph is trying to answer. He's leading a study to investigate whether food labels should include information about genetically modified (GM) foods.

"Genetic modification means different things to different people," says Prof. Castle. "We're looking at the issue from an ethical standpoint and trying to determine more than just whether or not people want the information, but also why they want the information and how they will use it."

In previous surveys, Canadians have said they want GM foods labelled, and would prefer more information as opposed to less. However, they don't specify what type of information they would prefer. As well, they don't identify why they want that information. Prof. Castle says this makes it difficult to determine what information—and how much—is appropriate.

Prof. Castle is working with Guelph graduate students Chris Norman and Anthony Vander Schaaf to analyze existing studies and conduct focus-group exercises, to determine whether labelling GM foods would be useful to consumers and what motivates them to buy GM or non-GM products.

Most recently, Prof. Castle authored *Convergence in Biotechnology Innovation: Case Studies and Implications for Regulation*. This new report outlines the regulatory changes Canada would need to consider to benefit economically and socially from biotechnology innovation.

It also identifies gaps and obstacles in the regulatory system and recommends changes in how biotechnology regulation should be governed. The report focuses on three novel biotechnology innovations: nutrigenomics or personalized nutrition, based on the interaction between nutrients and genes; plant-derived vaccines (producing vaccines for humans in crop plants); and the Enviropig, a line of pigs developed at Guelph that are genetically modified so their bodies can breakdown a normally indigestible form of phosphorus.

(left to right): David Castle, Anthony Vander Schaaf, Vinay Kanetkar, Chris Norman and Karen Finlay are researching the impact of food labelling.

funding profile

DAVID CASTLE

- **Social Sciences and Humanities Research Council (sub-award from another university)** **$25,000**
- **Advanced Food & Materials Network (Networks of Centres of Excellence)** **$166,000**
- **Ontario Research and Development Challenge Fund** **$70,000**
- **Ontario Genomics Institute** **$700,000**

UNIVERSITY of GUELPH

Guelph Researcher Tackles Ovarian Cancer

Jim Petrik, Professor and biomedical scientist at the Department of Biomedical Sciences, is targeting the most aggressive and lethal form of cancer among women—ovarian cancer. His research focuses on the growth, development and potential treatment of ovarian tumours.

Ovarian cancer is a poorly understood disease, says Prof. Petrik. It can present itself as a number of different types of afflictions, making it difficult to detect. So understanding how tumours begin and grow, is the first step in developing effective treatment plans.

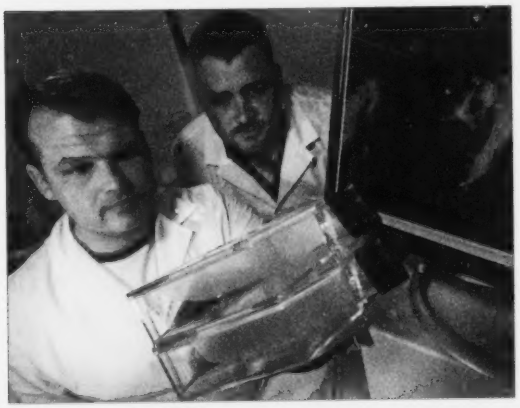
"Anything that can be done to improve treatment outcomes will have a significant impact on the length and quality of life for those individuals suffering from this disease," he says.

Specifically, Prof. Petrik is studying the use of a molecule called thrombospondin to prevent the formation of blood vessels that supply blood to cancer tumours in ovaries.

His research could potentially lead to the development of powerful therapies to combat or prevent the disease. The next step is to study angiogenesis—the growth of new blood vessels—and its role in regulating ovarian tumour formation. According to Prof. Petrik, an angiogenesis inhibitor is derived from a protein produced within the body and could be a safer treatment option than some traditional chemotherapy.

Prof. Petrik's PhD graduate student Jim Greenaway has been a vital part of the project's success. Jim has generated an animal model of the disease, which spontaneously develops ovarian tumours, in a similar fashion to the progression of the human disease. He will present his work at the 3rd National Conference on Ovarian Cancer Research in British Columbia.

Dr. Roger Moorehead, Department of Biomedical Sciences, University of Guelph, and Dr. Jack Lawler, Department of Medicine, Harvard University and Beth Israel Deaconness Medical Center, are collaborating with Prof. Petrik on his research.



Prof. Jim Petrik is focusing his research on the growth, development and treatment of ovarian cancer tumours.

funding profile

JIM PETRIK

◗ Natural Sciences and Engineering Research Council	$125,000
◗ Canada Foundation for Innovation	$131,303
◗ Ontario Innovation Trust	$131,303
◗ Ontario Ministry of Agriculture, Food and Rural Affairs	$114,000
◗ Ontario Cancer Research Network	$505,321

Lakehead
UNIVERSITY

Studying the Geochemistry of Northwestern Ontario

Pete Hollings, Associate Professor in Lakehead University's Geology Department, is studying how to apply whole rock geochemistry and petrology to the exploration of ore deposits. His research has led to the discovery of additional platinum group element (PGE) mineralization at the Seagull Intrusion, located 52 km southeast of the Lac Des Iles Mine.

Among the few North American bodies of rock showing platinum (Pt) and palladium (Pd) concentrations of more than a gram per ton, the Seagull Intrusion is one of the best new targets in North America for reef-style PGE mineralization, and one of the more interesting PGE exploration targets on a global scale.

Working under Dr. Hollings, graduate student Geoff Heggie is pursuing his thesis on whole rock geochemistry, mineral chemistry, petrology and Pt, Pd mineralization of the Seagull Intrusion. This research earned Geoff a share of the 2004 Discovery of the Year Award from the Ontario Prospectors Association.

Diamond-drill core sampling, conducted by Geoff as part of his research and supervised by Dr. Hollings, led to the discovery of new platinum-palladium horizons in the Seagull Intrusion. As a result of this discovery, the region has enjoyed increased funding for follow-up exploration.

Dr. Hollings has also been working with his graduate students on the Lake Nipigon Region Geoscience Initiative—a project to unravel the history of the lake's one-billion-year-old midcontinent rift. This work has led to new insights into the geology of the region and has contributed to increased exploration in the area.

The geochemistry research of Dr. Hollings has brought significant economic benefit to the Lake Nipigon area.

Dr. Pete Hollings in the field exploring ore deposits.

funding profile

Natural Sciences and Engineering Research Council	$38,670
Canada Foundation for Innovation	$79,347
Ontario Innovation Trust	$79,347
Ontario Prospectors Association	$155,095
East-West Corporation/ Industrial Research Assistance Program	$30,000
Placer Dome (CLA) Limited—Musselwhite Mine (shared with two other researchers)	$50,000

Lakehead
UNIVERSITY

Green Technologies for Remediation of Industrial Waste

Aicheng Chen of Lakehead University's Department of Chemistry is developing new green technologies to treat industrial waste from the mining and pulp and paper sectors.

"The economy of Northwestern Ontario relies heavily on the mining and pulp and paper industries, and electrochemistry has tremendous potential to address environmental problems in these areas through recovery of chemicals, destruction of toxic organic pollutants and remediation of wastewater," says Dr. Chen. "The ability to effectively reduce gas emissions such as hydrogen sulfide and mercaptans, and to remove or convert toxic pollutants in waste streams has become increasingly important to protect our environment."

And this is what Dr. Chen is working to accomplish. The unique electronic, optical and catalytic properties of nanomaterials provide a great opportunity to develop new electrochemical sensors for pollutants analysis and electrocatalysts for wastewater treatment. Dr. Chen is focusing on the design of new nanostructured materials, and the relationship between the size and structure of these materials and their electrochemical and photocatalytic potential to oxidize toxic pollutants. These pollutants include sulphur compounds and phenolic species—the most common wastes of the pulp and paper, petroleum, mining and chemical industries.

"Electrochemical interfaces are unique in surface science in that the surface potential/work function is controlled or known," says Dr. Chen. "It is anticipated that the electrochemical characterization of nanostructured materials in controlled-potential environments will turn out to have a distinctly broad importance in nanoscience and nanotechnology. These studies will provide insight into how to functionalize nanomaterials, how to design new electrochemical sensors with high selectivity for pollutants analysis, and how to develop efficient electrode materials for wastewater treatment."

▼ Dr. Aicheng Chen is focusing his research on greener ways to treat industrial waste.

funding profile

Canada Research Chair	$500,000
Natural Sciences and Engineering Research Council	$225,000
Canada Foundation for Innovation	$125,000
FedNor	$141,000
Industrial Support	$75,000

Lakehead
UNIVERSITY

Encouraging Students' Natural Mathematical Abilities

Alex Lawson of Lakehead University's Faculty of Education wants to improve how math is taught, particularly in the elementary grades. Funded by the **Social Sciences and Humanities Research Council**, she is conducting a longitudinal study called The Development and Progression of Children's Invented Calculation Methods: From Direct Modeling to Efficient Algorithms. Aspects of the study have already informed her role as co-chair of the Government of Ontario's Expert Panel on Mathematics in Grades 4 to 6 in Ontario and the report's subsequent publication.

The inspiration for Dr. Lawson's study began 10 years ago, when the Government of Ontario began to change math teaching. Similar changes were underway in the United States, supported by research that could verify the effectiveness of these new techniques. However, little related research was being done in Canada.

Dr. Lawson decided to address this void. She began by designing and delivering a full-year course on new strategies for teaching math. After teachers had gained experience with her new, more rigorous techniques, Dr. Lawson moved into the classroom herself to become better acquainted with the children, children she planned to interview later. She wanted to ensure they were comfortable with her and more responsive during the interview.

The interview process typically began with an initial series of mathematical problems given to each child, who was then asked to explain how he or she arrived at the answer. Each interview was recorded and made into a small movie to be analyzed by Dr. Lawson. She plans to track these students through their next six years of elementary school.

Through her research, Dr. Lawson intends to follow the mathematical development of children who use their own methods to solve mathematical problems. She already has a good picture of this development in the primary grades and is now looking at the junior grades to determine whether these children demonstrate a stronger understanding of mathematics and a greater mathematical capacity than children taught more traditionally. Dr. Lawson plans to share her findings with school boards and teachers using video records of children's mathematical growth over time.

▼ Dr. Alex Lawson is examining new ways to teach math to children.

funding profile

- Social Sciences and Humanities Research Council — $85,098

Madge Watt, the Untold Story

Linda Ambrose is on the trail of Madge Watt—feminist, socialite and the first female master's graduate from the University of Toronto. This pioneer of women's rights has been a difficult subject to research, taking Dr. Ambrose from Collingwood and Toronto to a former quarantine station and private prison archive in British Columbia. There have also been stops in London and New York along the way.

"It's just going to take some collecting. I'll have to do the legwork," says Dr. Ambrose, who is planning to write her biography in 2007.

Madge Watt was a writer and Victoria socialite, renowned as the founder of the Women's Institutes in Britain, and the affiliated Associated Country Women of the World (ACWW), an umbrella organization of rural women's clubs. Today, ACWW has 70-million members and consultative status with the United Nations.

The Women's Institutes are a form of feminism—traditional in ways yet avant-garde in others, says Dr. Ambrose. "What Madge was doing was quite political in the ACWW and it's proved to be an enduring body. They're not the most radical but they are fighting for women who don't have a voice or don't have a loud enough voice to be heard."

Dr. Ambrose's **Social Sciences and Humanities Research Council (SSHRC)** grant has enabled her and five student researchers to assemble both a paper trail and an electronic timeline of Madge Watt's life, including all the book reviews she wrote under her pen name "Greta."

Many of Dr. Ambrose's student researchers are pursuing further studies in teaching, library sciences and history at Dalhousie, Nipissing, Queen's, and Carleton universities. One of her students won an **SSHRC** grant of $35,000 for three years.

Dr. Linda Ambrose (left) is researching feminist pioneer Madge Watt for a biography she plans to write in 2007.

funding profile

- **Social Sciences and Humanities Research Council** — $64,119

LaurentianUniversity
UniversitéLaurentienne

Daring to Dream Big and Small

When it comes to nanotechnology, Louis Mercier and his chemistry students dare to dream big and small.

Nanotechnology is the grey area in size between the microscale and the atom, with nanos being larger than atoms. The research community first took notice of nanoporous materials about 15 years ago, when a hard, sandy shell was discovered to build up around shampoo. This shell acted as a type of liquid sponge absorbing contaminants in water.

Inspired by this application, Dr. Mercier plans to build mini-catch and release nanosystems with the ability to absorb precious metals from industrial run off, improve the quality of gasoline, or deliver drugs in a medical situation.

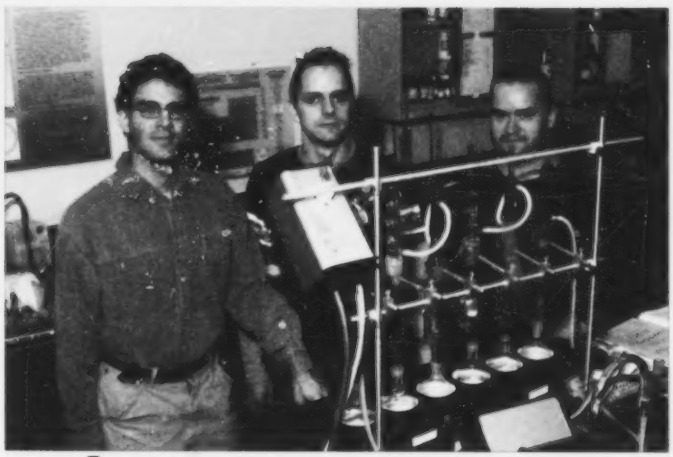
"If we can make something that will target certain types of drugs, we could have a drug-delivery system with the potential to slowly release drugs into the body."

While Dr. Mercier's work is still in the early stages, many partners are already on board including Imperial Oil, Inco, Placer Dome and Dr. Laxman Amaratunga in Laurentian's School of Engineering.

Dr. Mercier is assisted in his research by an undergraduate student and two master's students—one of whom is also working in Inco's analytical lab preparing to defend his thesis. Through a joint project with the School of Engineering, Dr. Mercier expects to hire two PhD students to study precious metal recovery for the mining industry.

"They contribute their own ideas toward the project, which is important for any student. You also want to foster some independence so they can eventually develop their own scientific careers."

While research strictly for its own sake is enjoyable, Dr. Mercier prefers his work to contribute to the greater good. "I wanted to do something that was significant to society. Of course, as a scientist you end up stopping along the way and looking at the nuts and bolts of how things work. That's the more esoteric aspect of research."



Dr. Louis Mercier (left) is conducting nanosystem research for the mining industry.

funding profile

- Natural Sciences and Engineering Research Council
  - —Discovery Grant $178,320
  - —Collaborative Research and Development Grant $74,919
- Imperial Oil $69,000
- Inco/Emerging Materials Knowledge Network $10,000

Research with Northern Exposure

Balancing pages of grant applications and research is familiar territory to Ellen Rukholm, chair of Laurentian University's School of Nursing.

Dr. Rukholm, who is also head of the Canadian Association of Schools of Nursing, oversees nine federal and provincial grants and supervises nine graduate students, four of whom receive assistance through these grants. These grants enable her students to not only study and work in a state-of-the-art and collaborative environment, but also to meet their counterparts across Canada, she says.

"For nurse scientists, creating a professional network is critical for career development."

The focus of Dr. Rukholm's research is rural and Northern Ontario health care. Projects range from analyzing workplace environments to improving cardiovascular nursing services for low-income women and First Nations in a rural setting.

For Dr. Rukholm, rural Canada begins at Barrie and runs north to James Bay, with weather, isolation and lack of services serving as additional criteria.

"Health care professionals could do with more. They do amazing things with what they do have."

Dr. Rukholm's funding comes from a range of organizations including **Health Canada**, the **Canadian Institutes of Health Research**, the Heart and Stroke Foundation of Canada, and the **Ontario Ministry of Health and Long-Term Care**.

Dr. Ellen Rukholm (left) is focusing her research on ways to improve health care in Northern Ontario.

funding profile

Health Canada	$297,450
Canadian Health Services Research Foundation/ Ontario Ministry of Health and Long-Term Care	$200,000
Ontario Ministry of Health and Long-Term Care	$412,836
Ontario Workplace Safety and Insurance Board	$50,000

LaurentianUniversity
UniversitéLaurentienne

Fixing the Forklift

By building a better forklift, the pulp and paper industry hopes to reduce its staggering accident rates.

The statistics are grim: an Ontario Ministry of Labour study for 1990-95 noted 18 workers deaths. In the U.S., over the years 1980-94, 1,021 workers were killed; in 1991, a peak year of worker deaths, 151 workers were killed in forklift accidents. There were also many serious and minor injuries in Canada and the U.S. Visibility and unsafe facility design were cited as major contributors to the incidents.

To address these issues, the pulp and paper industry and the Occupational Health Clinic for Ontario Workers sought the support and research of the Human Kinetics department at Laurentian University and Sylvain Grenier. He is the principal investigator in a study analyzing what happens when forklift drivers have reduced visibility, the postures they adopt because they can't see and the strains on the body from the postures they assume in order to compensate.

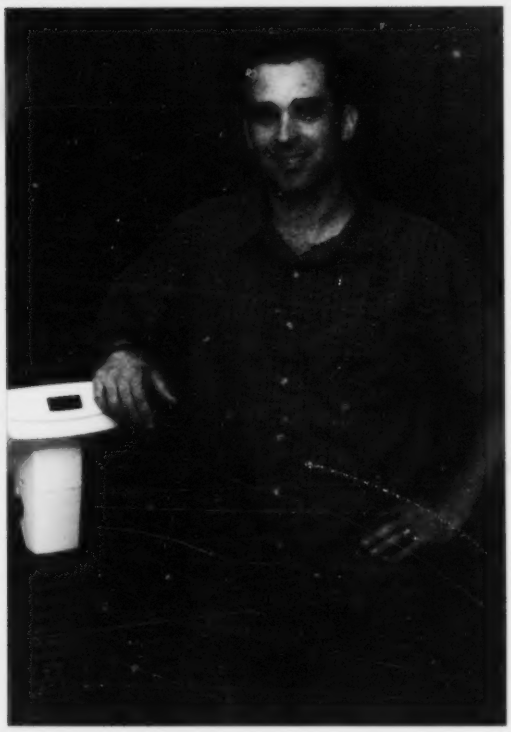
"One of the things we're seeing is when people are driving backward, they're not looking backwards."

This restricted line of sight seems to be the primary problem, he says. The visibility restriction forces people to adopt awkward postures, ones they cannot maintain. And to ease this musculoskeletal strain, they sacrifice their line of sight, leading to accidents such as driving off loading docks, he adds.

Based on this research, Dr. Grenier plans to recommend to manufacturers design changes that will improve this critical line of sight.

He is also a co-investigator on a Workplace and Insurance Board (WSIB) study of vibrations on heavy equipment in the workplace. Most underground construction machines vibrate at levels harmful to workers. This study will investigate whether frequency changes to construction machines can be transmitted to workers and thus prevent injuries. As well, the study intends to see whether workers can detect the most harmful vibrations, says Dr. Grenier.

The two year study, led by Dr. James Dickey at the University of Guelph, renews a project begun in 2001.



Dr. Sylvain Grenier aims to reduce workplace accidents through his research into forklift design and manufacture.

funding profile

- **Workplace and Insurance Board**
  - **—Principal Investigator** **$138,600**
  - **—Co-Investigator** **$253,930**
  - **$245,443**

LaurentianUniversity
UniversitéLaurentienne

Implants that Corrode

Corrosion is actually a good thing for Joy Gray-Munro, especially when it comes to a substance like magnesium.

The Laurentian University chemistry professor hopes her research will lead to a time when stainless steel pins are no longer used to repair broken bones. She thinks biodegradable magnesium alloys are a better alternative. "The thing about magnesium is your body needs it, as long as you can control the corrosion rate."

Dr. Gray-Munro wants to use magnesium's ability to corrode to her advantage. "We want to use the corrosion so the pins dissolve over time and are replaced by real bones.

"I'm interested in solving real problems with an eye to understanding the fundamental science."

She believes, with our aging population, it's important to develop better and cheaper medical implants. But to make this happen, new research into surface chemistry must be carried out. That way, any adverse reactions—such as magnesium pins corroding before the bones have actually healed—can be resolved before magnesium implants are used to replace steel pins.

Dr. Gray-Munro is also studying how magnesium can help the automotive and mining industries.

▼ Dr. Joy Gray-Munro is exploring the medical potential of biodegradable magnesium alloys.

funding profile

◗ Natural Sciences and Engineering Research Council	$81,000
◗ Canada Foundation for Innovation	$58,828
◗ Ontario Research Fund —Research Infrastructure	$58,828
◗ Ontario Centres of Excellence (Materials and Manufacturing Ontario)	$80,206
	$275,000

LaurentianUniversity
UniversitéLaurentienne

Dr. Kate Tilleczek is researching why some Ontario students don't graduate from high school.

Lessons in Theory and Real Life

Kate Tilleczek enjoys building bridges between the theories of learning and the often hard reality of life for children and adolescents.

Now she is "mining the data" that may tell why an estimated 30 percent of Ontario students don't graduate from high school.

The associate professor in Laurentian University's Department of Sociology was the lead investigator and one of four authors of a 179-page report investigating why young people leave high school without graduating.

Since September 2005, Dr. Tilleczek has been working with her sociology students and colleagues to review the issues raised during hours of interviews with secondary school students across Ontario. She has been spending plenty of time in Toronto boardrooms summarizing the work for leaders in education and child and youth services.

A self-described "working class kid" from Barrie, Dr. Tilleczek is the sixth of seven siblings to an Irish Catholic mother and labour leader father. Education was important in her family life, she says. A former school teacher, she is especially interested in child and youth culture, and issues of empowerment, marginality, and how education relates to the developmental health of young people.

Dr. Tilleczek believes volunteering is key to her research and community commitment. She sits at the Mayor's Round Table on Children First, a broad-based Sudbury group developing a local report card on children in the city. As well, she has volunteered with the Sudbury steering committee on the Working Poor, and the Steering Committee of the Status of Northern Child and Youth Health.

Dr. Tilleczek is also a filmmaker. She produced the documentary film *Lost in the Wood: Traversing the Rural Children's Mental Health System* with her Laurentian University colleagues at the Centre for Rural and Northern Health Research and the Hospital for Sick Children in Toronto. Nationally renowned for its analysis, the film is in demand by many institutions.

In 2006, she will chair a number of sessions at the Canadian Sociology and Anthropology Association and will speak in South Africa at the International Sociological Association where she will be the Canadian representative on the panel discussing the state of youth.

funding profile

Canada Foundation for Innovation	$25,025
Ontario Research Fund —Research Infrastructure	$25,025
Canadian Health Services Research Foundation, Canadian Mental Health Association and Northeast Mental Health Association	$176,978
Ontario Ministry of Education and Training	$480,000
Northern Ontario School of Medicine	$35,000
Public Health Research, Evaluation and Development Program and Laurentian University	$4,650
The Council of Ontario University Programs in Nursing and Health Canada	$68,438

McMaster University

Inspiring Innovation and Discovery

Dr. Catherine Hayward is helping to train future academic clinicians.

Stop the Bleeding

The hallmark of Catherine Hayward's career is her talent for capturing so many firsts in her specialty—the study of molecules important for clotting and vascular repair in patients with bleeding disorders.

Fifteen years ago, Dr. Hayward made scientific history when she discovered an unknown protein called multimerin—one of the largest proteins in the human body that is released with blood vessel injury. Studying individuals with multimerin deficiency, and the bleeding problems associated with it, led her to discover the Quebec Platelet Disorder (QPD), an abnormality that transforms platelets into clot busters. She is now investigating its genetic cause and how it triggers bleeding.

Her recent papers were the first to be published on how multimerin interacts with clotting factor V, which, in platelets, exists as a polymer. Multimerin works as a glue that binds blood platelets, leukocytes, blood vessel lining cells and many other cells types. Normally, it's hidden inside cells until an injury triggers its release to increase cell sticking at the injury site.

Dr. Hayward's next research initiative is to test spontaneous gene deletion, which removes most of the multimerin gene. This will reveal multimerin's function as a glue inside the body (where many proteins are present to bind to cells) and its clotting function as a binding protein for coagulation factor V—a property that makes clots form faster. Dr. Hayward believes that multimerin helps deliver factor V when and where clotting needs to happen.

Last year, researchers around the world learned Dr. Hayward and her research group had developed the first detailed questionnaire to evaluate risks faced by patients with and without bleeding in the QPD family. The research team is now applying this assessment tool to other bleeding problems.

Dr. Hayward's current students—three PhDs, two postdoctoral fellows and an undergraduate—reap the rewards of her commitment to both research and education. Outside of the laboratory, she is Director of the McMaster University Clinician Investigator Program which provides structured training for future academic clinicians who intend to pursue research as a key component of their medical career.

funding profile

Canada Research Chair (2005-2010)	$500,000
Canadian Institutes of Health Research	$590,000
Canada Foundation for Innovation	$189,900
Ontario Innovation Trust	$189,900
Premier's Research Excellence Award*	$150,000

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

McMaster University

Inspiring Innovation and Discovery

▼ Dr. Robert Pelton's mission is to produce highly trained grads for Canada's pulp and paper industries.

Pulp Facts—Not Fiction

You pick up a cardboard box in your damp basement and your grandmother's china falls through the bottom and crashes onto the floor because the wet box was too weak. You wonder why science can't come up with something better. Well, stay tuned because it's in the works, thanks to Chemical Engineering Prof. Robert Pelton.

Dr. Pelton is Director of the McMaster Centre for Pulp and Paper Research where the focus of research is on developing new polymers and biopolymers to improve paper products.

McMaster University is one of the leading centres for pulp and paper research in Canada. Recently, its researchers submitted patents describing a new way to strengthen wet paper products, in collaboration with the Canadian government and BASF Canada—the world's largest chemical company—both of whom provided funding.

Since the pulp and paper industry is the largest contributor to Canada's trade surplus, Dr. Pelton wants Canadians to know how important it is to keep the sector competitive.

His research is focused on developing better polymers (chemicals) used in papermaking and finding new ways to replace synthetic (oil-based) polymers with engineered biopolymers from natural products, such as potatoes and corn. The goal is to develop a paper product that is both stronger and environmentally friendly.

Dr. Pelton's group—considered the world's largest, most prolific academic research group working in the area of polymers for papermaking—provides ideal learning opportunities for graduate students and postdoctoral fellows. They learn how to design, synthesize and characterize polymers; put them into paper materials; and measure and model paper properties; thus providing valuable tools for Canadian papermakers.

Todd Hoare, a fourth-year chemical engineering PhD candidate was runner-up in the 1995 Innovation Challenge Award competition sponsored by the **Natural Sciences and Engineering Research Council** for his work on "glucose-responsive microgels for self-regulating insulin delivery." Next year, five more graduate and postdoctoral students will be added to their team, bringing the total to 17.

funding profile

◗ Canada Research Chair	$1.4 million
◗ Natural Sciences and Engineering Research Council	$1.3 million
◗ Canada Foundation for Innovation	$196,228
◗ Ontario Innovation Trust	$196,228
◗ Industry Partners	$1.1 million

McMaster University

Inspiring Innovation and Discovery

The Economy of Aging

Within the next 30 years, the day-to-day life of every Canadian will feel the impact of the baby boom generation as today's 40- to 60-year-olds ease into old age.

What's still not known are the fundamental and unprecedented changes that are in store for Canada's labour force and economy from this rapidly expanding group of seniors.

McMaster University Economics Prof. Byron Spencer is leading a team of 46 Canadian and international scholars from 14 Canadian and three overseas universities. Their research is expected to uncover the information that policy-makers need to find solutions for what Dr. Spencer calls "monumentally important public issues."

Researchers expect to learn:

- How population aging differs across provinces/cities/regions of Canada and the consequences;
- What increases should be expected in the number of people in poor health;
- How sensitive projections are to different assumptions about future levels of immigration, changes in mortality and fertility, definitions of old age, and measures of health status; and
- What gains are anticipated in health expectancy.

In particular, this research will examine the role of immigration in population and labour force growth, future demand for health care, and the viability of public and private pension plans.

Currently, there are four Canadians in the workforce for every senior citizen, but in less than 30 years, that ratio will drop to only two workers for every senior.

The research project, entitled Canada in the 21st Century: Moving Toward an Older Society, builds on an earlier program underway since 1999, known as SEDAP: Social and Economic Dimensions of an Aging Population.

Close to 50 person-years of graduate student support was involved in the initial project—well beyond the 30 person-years originally proposed—and graduate students are well integrated into the current program's research activities.

▼
Dr. Byron Spencer is examining the social and economic implications of the baby boom generation's pending retirement.

funding profile

- **Social Sciences and Humanities Research Council** — **$2.5 million**
- **Other—including nine Canadian universities, seven institutions in Canada, the Danish National Institute for Social Research, and the Institute for the Study of Labor in Germany** — **$2.7 million**

McMaster University

Inspiring Innovation and Discovery

Fishing for Ways to Understand Behaviour

Cichlids are tiny fish—some as small as your baby finger—but to Sigal Balshine, **Canada Research Chair** in Aquatic Behavioural Ecology, these aquatic denizens are labs with fins, providing her with a wealth of data to study evolutionary social behaviour.

Dr. Balshine, a psychologist and behavioural ecologist, uses the cichlid fish from Lake Tanganyika in Africa as a model organism, a social species unusually suited to experimentation in both the lab and the field. Her pioneering work seeks to understand the evolution of social behaviour—how co-operation and conflict influence the brain, behaviour and physiology, both in male and female animals.

Cichlids live in groups composed of a dominant breeding pair and non-breeding helpers and exhibit co-operative behaviours when it comes to defending their territory and their young. While scientists have traditionally believed that co-operation evolved from kin selection—that individuals will help relatives to ensure that their shared gene pool will continue to the next generation—Dr. Balshine's lab group has demonstrated that in certain situations unrelated individuals will actually help more.

Kelly Stiver, a PhD student in Dr. Balshine's research group has conducted experiments both in the lab and observed underwater in Lake Tanganyika. Combining behavioural observation with genetic analyses, Kelly and Dr. Balshine discovered that unrelated individuals might be required to do more work than related individuals to be allowed access and enjoy the benefits of being part of a group.

"While some helpers work or care for young because they are related to the dominant breeders, we also observed that other unrelated helpers work as a kind of rent payment," notes Kelly.

The Balshine group seeks to answer the big questions in the evolutionary field: are some behaviours a consequence or a cause? Which traits are genetic and which traits are shaped by environment? Their research is the first to examine the influence of co-operation and conflict on the brain and the physiological mechanisms behind behaviour, including changes in brain anatomy.

▼ Graduate student Kelly Stiver, left, and psychologist Sigal Balshine, study the cichlid fish to learn more about evolutionary social behaviour.

funding profile

SIGAL BALSHINE

◗ Canada Research Chair	$500,000
◗ Natural Sciences and Engineering Research Council	$445,817
◗ Canada Foundation for Innovation	$196,808
◗ Ontario Innovation Trust	$186,463

McMaster University

Inspiring Innovation and Discovery

Radiophobia—Fact or Fiction

Over the years, we've heard that radon gas in basements causes lung cancer, that fallout from bomb testing mutates babies and that exploding reactors such as Chernobyl contaminate the world, destroy wildlife and kill hundreds of people. On the other hand, we know that Canada has one of the world's largest supply of uranium, and the CANDU reactor has a proven track record for energy efficiency, environmental cleanliness and safety.

So why, then, aren't we enjoying a surplus energy supply and profiting from selling our power internationally? Radiation biologist Doug Boreham knows the answer—it's radiophobia. People don't understand the biological effects of radiation, so radiation creates fear—and Hollywood hasn't helped. He'd like to change all of that by giving Canadians the information they need to make informed decisions.

Dr. Boreham is a world leader when it comes to low-dose radiation health effects. His lab is equipped with Canada's first biological microbeam to conduct unique low-dose radiation research. The beam delivers single or multiple charged ions into a precise target within a cell, so that its effect can be determined accurately—with pure facts and no fiction. His work will go a long way in developing future protection policies for workers.

His research, and indeed his personality (he's the recipient of several teaching awards), draws a unique blend of students—both undergraduate and graduate—to his courses. And it's not always about what he teaches, but how he teaches. Wanting his students to see first-hand the effects of the atomic bomb on human health, he and his colleague, Fiona McNeil, took their class on a field trip—they spent 12 days in Hiroshima examining the short- and long-term impact of nuclear weapons testing on humans and the environment.

Radiation biologist Doug Boreham believes fear of radiation keeps Canadians from enjoying the energy and profit potential of nuclear power.

funding profile

Natural Sciences and Engineering Research Council	$250,000
—Industrial Chair	$1.2 million
Canada Foundation for Innovation	$919,240
Ontario Innovation Trust	$288,123
Ontario Research Fund —Research Infrastructure	$600,000
Atomic Energy of Canada	$270,000
Ontario Power Generation	$18,500
U.S. Dept. of Energy, Division of Nuclear Physics	$107,142
U.S. National Institutes of Health	$300,000
Contract Research	$1.8 million

NIPISSING UNIVERSITY

Building Britain's Identity: Examining the British Empire Exhibition, 1924-25

The year is 1924 and the first British Empire Exhibition opens. Designed to rebuild British confidence after the First World War and to strengthen commonwealth unity, the exhibition encompassed over 200 acres of pavilions, rides and restaurants, and attracted approximately 25 million visitors.

Anne Clendinning of Nipissing University's History Department is using this exhibition as a case study to investigate the cultural, social and economic significance of world exhibitions.

Her research will explore:

- The political and economic motivation behind the British Empire Exhibition;
- How the rhetoric of imperial unity was used throughout the exhibition to promote economic growth;
- The social and economic effect of the exhibition at the community level;
- How the exhibition redefined Britain's image from a Victorian empire to a distinct and modern society;
- How public exhibitions, as invented traditions, construct and portray national identities in formation; and
- How race and gender represented at the exhibition convey cultural and commercial hierarchies.

A number of undergraduate students are helping Dr. Clendinning with her research, locating and compiling primary source material such as government documents, newspapers, business records and personal papers. Once the project is closer to completion, Dr. Clendinning plans to work with a film or media studies graduate student to develop a DVD on the exhibition. This will complement the other major outcome of her research, an upcoming book entitled *Consuming the Commonwealth: the British Empire Exhibition, 1924-25*. This publication will focus on the exhibition within the context of Britain's social and economic recovery following the First World War.

Dr. Clendinning, an expert in 19th- and 20th-century Britain, hopes her research will build interest and scholarship in how national identities are constructed. Through her work, she seeks to prove that nationalism is not a natural occurrence, but a concept constructed in public spaces.

funding profile

Social Sciences and Humanities Research Council	$44,345
Nipissing University Internal Research Grant	$5,000

▼ Dr. Anne Clendinning and a student researcher examine maps and pictures of the 1924 British Empire Exhibition, a fair designed to boost British self-confidence and economic prosperity after the First World War.

NIPISSING UNIVERSITY

Easing Growing Pains: Maximizing Harvest Output for Canadian Growers

If biologist Ewa Cholewa has her way, we could be sitting at the harvest dinner table several times a year.

Dr. Cholewa is focusing her research on the chain of chemical reactions that govern plant growth. Understanding these steps, and the signals required to stimulate them, could lead to shorter maturation times for plants and crops.

In turn, manipulating the maturation cycle could lead to earlier and more frequent harvests—a significant benefit to farmers and gardeners alike, particularly those who work in areas with unpredictable weather.

Dr. Cholewa uses a Confocal Laser Scanning Microscope for her research, purchased with a portion of her 2005 **Canada Foundation of Innovation** (CFI) grant. A key research tool, it provides the opportunity to observe fast and dynamic responses to signals in living tissue.

Seven undergraduate students are working with Dr. Cholewa on basic research projects with potentially significant applications. For instance, Sarah Bogart is investigating an indigenous plant that thrives in harsh conditions and has the natural ability to contain, degrade or remove toxic chemicals and pollutants from soil or water. Another student, Jennifer Janusz, is researching how leaves compensate for the loss of water pathways.

Dr. Cholewa demonstrates a deep understanding of the need to respect, nurture and cultivate our essential relationship with the natural world. Exploring and utilizing a plant's own genius is a sustainable approach to maximizing nature's bounty while meeting the realities of consumption today and for the future.

Dr. Ewa Cholewa is researching ways to manipulate plant growth.

funding profile

◗ Canada Foundation for Innovation	$448,247
—Operating Grant	$134,474
◗ Ontario Research Fund	
—Research Infrastructure	$448,247

NIPISSING
UNIVERSITY

Forecasting Chaos

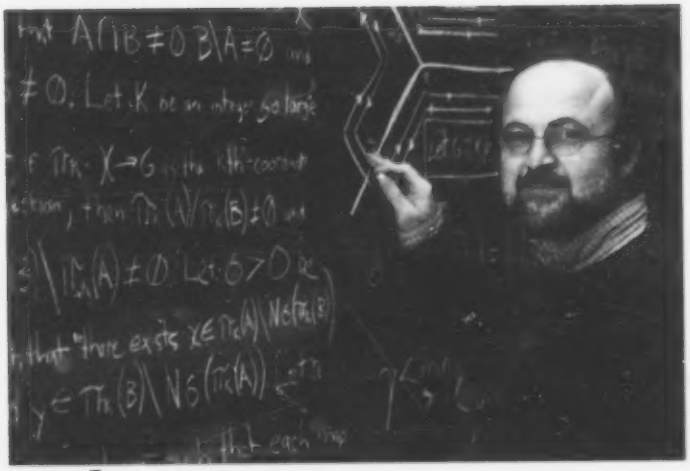
Some gaze into a crystal ball to see into the future. Murat Tuncali, Professor of Mathematics at Nipissing University, looks into complicated patterns to make his predictions.

A topologist, Dr. Tuncali studies the features of an object after it has been altered through stretching or bending. For example, topologically speaking, a circle and a square are the same—both can become the other without tearing or gluing. However, a circle and a figure eight are different, because you would have to tear the figure eight to restore it to a circle.

Dr. Tuncali's interests lie in understanding the mathematics of complicated patterns exhibited by simple equations. His specialty is continuum theory; researchers in this area have been studying such patterns for over a century. Mathematical patterns can be applied to patterns that occur in apparently unrelated areas such as the study of population shifts, or economic models. Dr. Tuncali's research explores how small errors can lead to chaos.

Dr. Tuncali has held **Natural Sciences and Engin[illegible] Research Council (NSERC)** grants since 1993. [illegible]ear **NSERC** grant awarded in 2004 allows him to pursue his research in continuum theory, topological dynamics, complex dynamics and general topology. Dr. Tuncali is also one of the managing editors of the *Topology Proceedings Journal*, published jointly by Nipissing University and Auburn University.

Over the past three years, Dr. Tuncali has employed Nipissing students to work on projects relating to topological dynamics and chaotic behaviour.

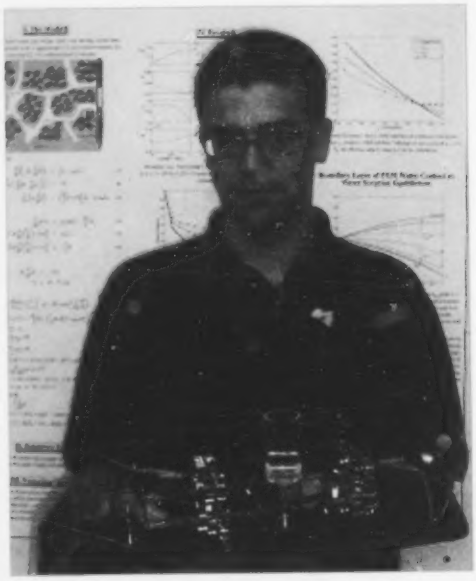


Dr. Murat Tuncali is interested in the mathematics of complicated patterns.

funding profile

▸ Natural Sciences and Engineering Research Council	$45,000

University of Ontario
INSTITUTE OF TECHNOLOGY



Dr. Peter Berg is studying how improvements to fuel cell design may lead to greater efficiency and lower cost.

Fine-Tuning a Fuel of the Future

Powered by his passion for the environment, Peter Berg has travelled a winding road researching one of the world's best hopes for clean power.

Dr. Berg, Professor of Physics at the University of Ontario Institute of Technology (UOIT), was born and raised in Germany and studied physics at the historic University of Münster. In 1998, he moved to England's University of Bristol to pursue a PhD in applied mathematics and a long-standing interest in traffic flow, the subject of his thesis. But like a rush-hour commuter, he eventually threw up his hands, concluding that the fight to reduce traffic congestion in urban areas was a losing battle. He later turned his attention to another form of pollution control, fuel cells, and landed a three-year, postdoctoral fellowship with Vancouver-based Ballard Power Systems Inc., a world leader in fuel-cell technology.

With funding from the **Natural Sciences and Engineering Research Council** and partnering with Mathematics of Information Technology and Complex Systems (MITACS), a Vancouver-based **Networks of Centres of Excellence** and the original organizer of his post-doctoral fellowship, Dr. Berg intends to design a fuel cell with increased efficiency and lower cost.

Dr. Berg's work focuses on the catalyst layer—the heart of the fuel cell—where electrical power is produced through a controlled chemical reaction between hydrogen and oxygen. While this reaction produces very clean power, because the catalyst layer contains platinum, it is very costly power. "Hydrogen fuel cells seem to be the only viable green technology for the auto industry in the long run," says Dr. Berg. "But they're still way too expensive."

Currently, the platinum in a fuel cell powering an average car would cost about $100,000, or $1,000 per kilowatt of energy. Add in special storage technology, compressors, motors and other high-tech accoutrements, and the cost of a fuel cell car could quickly reach $250,000, says Dr. Berg. In comparison, today's internal combustion engine costs between $10 to $20 per kilowatt of energy produced.

Because of these enormous costs, he estimates it will be a minimum of 20 years before fuel cells are used in the auto industry. In the meantime, says Dr. Berg, governments should start seriously planning for the day when the oil wells run dry.

funding profile

Natural Sciences and Engineering Research Council	$76,000
MITACS (Networks of Centres of Excellence)	$10,000

University of Ontario
INSTITUTE OF TECHNOLOGY

Real World Experience Inspires Innovative Research

Remon Pop-Iliev could be a poster child for Ontario's newest university, the University of Ontario Institute of Technology (UOIT). As a former director of research and development for one of the largest manufacturing companies in the former Yugoslavia, this engineering professor fits perfectly with UOIT's mission as a market-oriented, innovative, global university.

What's more, Dr. Pop-Iliev, who came to Canada with his family in 1995, is relentlessly dedicated to innovation in manufacturing, materials and design. "Even as a kid, I was taking toys apart to find out how they worked," he recalls. "I was always trying to improve them, to make them unique in some way."

Through funding from the **Natural Sciences and Engineering Research Council**, Dr. Pop-Iliev is finding new ways to exercise his curiosity. One of his current projects is to develop a new process that could dramatically reduce the time required to manufacture highly durable, integral, skin-foamed plastics, used to produce large structures such as buoys, kayaks, storage tanks and playground equipment. "If this project is successful, it could create a revolution in this industry," he says.

As the speaker of six languages, Dr. Pop-Iliev is also interested in the dynamics of globalization and how it affects communication and collaboration on design teams. Through AUTO21, a **Networks of Centres of Excellence** dedicated to advanced automotive technology, Dr. Pop-Iliev and researchers from six Canadian universities are evaluating tools for conducting collaborative design over distances. As part of the project, teams are using different collaborative tools to build two small electric vehicles. The resulting cars will be used to gauge which collaborative technology is superior.

He is also working with AUTO21 researchers to develop state-of-the-art plastic auto parts that will be lighter, more fuel-efficient and easier to produce than metal parts. "The auto industry," he says, "celebrates every pound that's reduced from a vehicle."

Dr. Pop-Iliev graduated with his PhD from the University of Toronto in 2002 and joined UOIT in 2003. "Canada," he notes, "is a country that provides good opportunities to everybody who wants to seize them."

Dr. Remon Pop-Iliev's research may lead to advancements in manufacturing processes.

funding profile

Natural Sciences and Engineering Research Council	$78,000
Auto 21 (Networks of Centres of Excellence)	$55,574

University of Ontario
INSTITUTE OF TECHNOLOGY

Marketing Tomorrow's Technology

Imagine a cellphone that squeezes orange juice or a toaster that surfs the web. Now imagine people actually buying these products. That is what Tripat Gill, Professor in the Faculty of Business and Information Technology, is studying: Why do consumers adopt some technological innovations and leave others collecting dust?

With the transformation of sound and pictures from analog to digital, computers, consumer electronics and telecommunications equipment are cross-pollinating to create products that were once the stuff of science fiction. These include personal digital assistants (PDAs) that double as phones, or cellphones that take pictures. "Things that were separate are coming together," says Dr. Gill. "For marketers, this convergence is creating real challenges."

For companies launching the latest gizmo, success or failure depends on consumer acceptance, says Dr. Gill. Inventors may soar to untold heights technologically, only to be brought crashing to earth by an indifferent public. The trash heap of history is littered with multi-purpose products that failed to capture the public's imagination, such as amphibious cars or elixirs that claimed to cure a multitude of ills.

For the sake of research, Dr. Gill is contending that consumers will prefer high-tech products with specialized functions related to communications, entertainment or information. To test his theory, Dr. Gill will gauge how consumers respond to certain hypothetical convergent products: cellphones with miniature televisions, PDAs with TVs, or Gameboy video game units with built-in TVs.

Dr. Gill will begin the three-year project by presenting a questionnaire to as many as 400 student subjects, asking them to evaluate and classify these new convergent gadgets as entertainment, communication or information products. In a subsequent study, the response times to classify these devices will also be measured. The faster the response times, he says, the more consumers are able to classify and understand the products, increasing the odds they will adopt them. He will then work with a market research firm to test a more representative sample of about 1,000 people.

Dr. Gill also plans to study the history of several key products and to see how readily they were adopted by consumers.

Dr. Tripat Gill is studying why consumers adopt some technological innovations but reject others.

funding profile

- Social Sciences and Humanities Research Council $63,588

uOttawa

L'Université canadienne
Canada's university

Killing Tumours by Allowing Them to Breathe?

Tissues starved of oxygen, a condition known as hypoxia, play an important role in normal human development, including embryonic growth and wound repair. Unfortunately, hypoxic tissues also play a role in the progression of several human diseases such as cancer and stroke.

"Tumour hypoxia can actually accelerate malignant growth, in addition to limiting the effectiveness of standard anticancer therapeutics," explains John Bell, Professor of Medicine at the University of Ottawa and researcher at the Ottawa Hospital Research Institute and the Ottawa Hospital Regional Cancer Centre. "This results in a poorer prognosis for the cancer patient irrespective of the chosen cancer treatment."

Working with prize PhD student Jaime Blais, Dr. Bell is focusing his research on understanding the molecular events that support the development of tumour cells resistance to hypoxia. By doing so, they hope to discover novel and effective anti-cancer therapeutics that can specifically target oxygen-starved tumours.

"Jaime is an exceptional addition to our lab," says Dr. Bell. "Over the past five years, she has independently directed research efforts to identify the signalling pathways that are exploited by a subset of aggressive tumour cells. Using gene chips, she was able to identify an interesting stress response that appears to be crucial to the survival and adaptation of aggressive tumour cells."

Dr. Bell and Jaime are investigating the function of this pathway in a variety of human cancer cell lines and will subsequently study the consequences of disrupting this stress response pathway in growing tumours.

▼ Dr. John Bell and graduate student Jaime Blais are investigating how oxygen affects tumour growth.

funding profile

◗ Canadian Institutes of Health Research	$105,570
◗ National Cancer Institute of Canada	$1,511,502
◗ Ontario Cancer Research Network	$344,520
◗ Other	$55,875

uOttawa

L'Université canadienne
Canada's university

Keeping on Top of the Copyright Crisis

With the proliferation and consolidation of digital technology and global communication networks making it easier than ever to copy and distribute information, copyright law is in crisis. As Daniel Gervais, Vice-Dean of Research and Professor of Technology and Intellectual Property Law at the University of Ottawa, observes, the stark choice in front of law and policy-makers seems to be to either forego digital copyright norms entirely or adapt the norms to encourage new markets for copyrighted works.

Considered one of the leading copyright scholars in the world, Dr. Gervais is investigating how Canadian copyright norms can be adapted in a way that will satisfy Canadian social, cultural and economic policy objectives, while remaining in line with international norms and emerging global market demands. Dr. Gervais has worked at copyright-collecting societies and the World Intellectual Property Organization, so his research is expected to be of particular benefit to Canadian policy makers.

Dr. Gervais works closely with undergraduate and graduate students in all his projects and is currently supervising Marina Pavlovic, the recipient of numerous grants and awards including a **Social Sciences and Humanities Research Council** doctoral scholarship and a University of Ottawa National Excellence Scholarship.

"I consider Dr. Gervais to be one of my strongest mentors," says Marina. "He's very supportive of my goals, and encourages me to push my limits. I look forward to the continued research we will pursue together."

Dr. Daniel Gervais and graduate student Marina Pavlovic are studying Canada's copyright laws.

funding profile

◗ Social Sciences and Humanities Research Council	$56,300
◗ Other	$130,000

uOttawa

L'Université canadienne
Canada's university

The Impact of Diabetes on the Brain

With roughly 150 million people suffering from diabetes worldwide, researchers are racing to stem what is rapidly becoming a global epidemic. In particular, researchers are working to gain a better understanding of the effect diabetes has on the brain.

Claude Messier, Professor and Assistant Director of the School of Psychology at the University of Ottawa, is studying the impact of diabetes on memory and cognition in humans and animals. He and his team have found that both memory and the capacity to perform complex mental tasks are impaired in older people who are not yet diabetic, but show early signs of the disease. Their research also suggests that diabetes increases the likelihood of developing dementia.

Dr. Messier mentors and supervises several graduate students in his human neuropsychology laboratory, including star student Nesrine Awad. Together, Dr. Messier and Nesrine have written several papers exploring the impact of diabetes on the brain. To encourage more involvement in the writing process, Dr. Messier regularly puts his students in charge of preparing the papers his lab publishes.

"Essentially, my laboratory has three major components: one dedicated to animal behaviour, one linked to molecular studies and another one dedicated to human neuropsychology," explains Dr. Messier. "In all three, students are encouraged to work together, as they study the effect of aging, diabetes and impaired glucose tolerance on brain functions."

Dr. Claude Messier and graduate student Nesrine Awad are pioneering research into the effect of diabetes on the brain.

funding profile

- Natural Sciences and Engineering Research Council — $107,120

uOttawa

L'Université canadienne
Canada's university

Predicting Evolutionary Moves

Natural selection is the engine that drives adaptive evolution, but what provides the fuel?

Mutations of course—specifically those that confer a growth advantage over the ancestor. But the spectrum of advantageous effects that fuels adaptation remains one of the most elusive patterns in evolutionary biology. Theories have remained virtually untested largely because beneficial mutants occur so rarely and, when they do, are difficult to isolate.

Yet Rees Kassen of the University of Ottawa's Department of Biology and Centre for Advanced Research in Environmental Genomics (CAREG) has developed an experimental system to isolate large numbers of mutations and estimate their growth advantage directly. His work has found that most advantageous mutations have a small effect on fitness, while a few have large effects.

"What these results mean is that we have, for the first time since Darwin put forward his ideas on evolution by natural selection, a clear picture of what natural selection "sees" when it chooses among new mutations," explains Dr. Kassen. "Our results suggest that it may be possible to predict the next evolutionary move of a microbial population when faced with a novel environment."

In collaboration with graduate students Jean-Nicolas Jasmin, Gina Schroeder, Sijmen Schoustra and Justin Meyer, Dr. Kassen is extending these results to cover the entire evolutionary process, with the goal of understanding how natural selection works. "Ultimately we would like to answer the question, Why are there so many species in the world? The work of these students is absolutely essential to achieving this goal."

Predicting the next move of pathogenic microbial organisms has far-reaching consequences for a number of fields, from agriculture to medicine. The potential design of efficient strategies for pest control and anti-microbial/viral drugs are just two examples.

Dr. Rees Kassen and graduate students Sijmen Schoustra (right) and Justin Meyer (left) are researching new mutations.

funding profile

- Natural Sciences and Engineering Research Council — $33,000
- Canada Foundation for Innovation — $200,000
- Ontario Research Fund —Research Infrastructure — $200,000
- Premier's Research Excellence Award* — $150,000
- Fonds France Canada pour la Recherche — $10,000

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

uOttawa

L'Université canadienne
Canada's university

Hypertension: Targeting the Silent Killer

Hypertension (high blood pressure) is a major killer, affecting more than five million adults in Canada alone. It is foremost among the risk factors for cardiovascular disease, stroke and renal failure.

"One of the great ironies of this disease is that it has little or no immediate effect on quality of life because it often remains undetected," explains Rhian M. Touyz, **Canada Research Chair** in Hypertension, scientist at the Ottawa Health Research Institute and physician at the Hypertension Clinic at the University of Ottawa. "Despite progress in treatment, the fundamental causes of hypertension remain elusive."

Dr. Touyz believes new findings from her research program will contribute to a greater understanding of the pathophysiological mechanisms that cause hypertension, leading to improved management and possible prevention of hypertension and its associated target organ damage.

Dr. Touyz's lab is student-orientated, with a major focus on training and mentoring the next generation of young scientists. Members of her multinational team, comprising trainees from China, Cameroon, Prague, Brazil, Australia, France, Italy and Canada, are all actively involved in their own research projects. Two of her senior trainees—postdoctoral fellow Glaucia Callera and graduate student Fatiha Tabet—have already made seminal findings regarding the identification of candidate proteins involved in vascular damage associated with hypertension.

"My students work exceptionally well together," says Dr. Touyz. "There is no doubt that the success of my lab is due primarily to the incredible dedication, commitment and seriousness of the extraordinary students in my group."

Dr. Touyz (left) and her multinational team of graduate students are working to improve the management of hypertension.

funding profile

Canada Research Chair	$1.4 million
Canadian Institutes of Health Research	$144,715
Canada Foundation for Innovation	$130,000
Ontario Research Fund —Research Infrastructure	$130,000
Heart and Stroke Foundation of Canada	$40,000
Heart and Stroke Foundation of Ontario	$93,828
Astellas Pharma Canada Inc.	$63,046

uOttawa

L'Université canadienne
Canada's university

Dr. Valerie Steeves (front right) and graduate students Natalie Bellefeuille, Anne Harewood and Tom Hillman research children's online behaviours and develop educational tools to teach kids how to protect their human rights in networked spaces.

"My work is unusual," she explains, "because I combine a theoretical interest in privacy as an essential part of identity formation, with a critique of the gap between current legal structures and the social realities in networked spaces on the one hand and a strong interest in public education on the other."

Dr. Steeves is a also strong proponent of mentoring graduate students, whom she believes, bring a much needed bundle of skills to her research.

"I call them the dream team," she says, referring to graduate students Natalie Bellefeuille (Law), Anne Harewood (Criminology) and Tom Hillman (Education).

"This kind of work is particularly difficult because it involves interacting with young people through web production, formal lesson plans and drama.

"I was impressed to see how my students' academic work became more nuanced as they strove to communicate complex concepts to kids. I strongly believe that the opportunity to participate in a very real and ongoing social dialogue about the role of new technologies will serve them well in the future."

Cyber-Savvy: Helping Children Protect Themselves Online

As networked technologies have reshaped the social spaces around us, the law has struggled to respond to a growing number of issues that involve privacy, security and social interaction. At this nexus of new technologies, law and human rights, University of Ottawa criminology professor Valerie Steeves is conducting research on children's online behaviours around privacy and anonymity, and the information practices on web sites that they frequent.

Dr. Steeves is the author of a number of award-winning educational games designed to teach children how to protect their human rights in cyberspace. Her interactive cyberplay about online privacy is used by Girl Guides across the country in the You Go Girl in Technology badge program.

funding profile

Social Sciences and Humanities Research Council	$44,765

Queen's UNIVERSITY

▼ Grad student Chris Ardern is developing new guidelines for treating cardiovascular disease in high-risk patients.

New Guidelines Assess Heart Risk

Can staying fit lower your chances of heart disease even if your cholesterol levels are high?

According to Chris Ardern, the answer is yes. Chris is a graduate student in the Physical Activity Epidemiology Laboratory at Queen's University's School of Physical and Health Education. He's working with Dr. Peter Katzmarzyk and a team from the Cooper Institute in Dallas, Texas, to analyze the effectiveness of modifications made in 2004 to the guidelines from the National Cholesterol Education Program Adult Treatment Panel III. Clinicians use these guidelines to assess a patient's risk of cardiovascular disease. The guidelines also help physicians determine what kind of therapies—exercise and dietary changes, or cholesterol-lowering drug treatment, for example—may be most appropriate for higher-risk individuals.

The study was based on an analysis of health and mortality data of 19,125 men who visited a preventive medical clinic between 1979 and 1995. The study results, published in *Circulation: Journal of the American Heart Association*, confirmed that the new guidelines are indeed effective at identifying men at risk of cardiovascular disease and death. Significantly, under the revised guidelines, an estimated 25 percent of American men ages 20 to 79 meet the criteria for aggressive cholesterol-lowering therapy. These men are also seven times as likely to die from cardiovascular disease as men who are at, or below, the acceptable LDL levels (considered the "bad" cholesterol) under the revised guidelines.

"The new guidelines should help save lives, because they lower the threshold for aggressive cholesterol-lowering treatment of high-risk men," says Chris.

The study also found that, regardless of their cholesterol level, men can cut their risk of heart disease in half by staying physically fit.

Engaging in high-level research is enormously rewarding for Chris, who hopes his doctoral work will lead to an academic position allowing him to teach, translate knowledge and address contemporary health and fitness issues.

funding profile

Joint Doctoral Research Fellowship
(Heart and Stroke Foundation of Canada and Canadian Institutes of Health Research)
(per annum) **$21,000**

Queen's UNIVERSITY

Promoting Physical Fitness at School

How much does a child's school life influence the amount of school and extracurricular physical activity he or she engages in?

Jennifer Robertson-Wilson has been exploring that question since 2002. In pursuit of her doctorate in health promotion and exercise psychology, Jennifer, a graduate student at the School of Physical and Health Education at Queen's University, surveyed the physical activity programs, facilities and practices of 32 middle (Grades 7 and 8) schools in and around Kingston, Ontario. She also surveyed 1,400 pupils at these schools to determine how much physical activity they participated in, both in and outside of school.

Other research indicates that individual characteristics—such as age, gender, body weight and self-confidence—help explain between 20 and 40 percent of children's physical activity level. Jennifer, who is the mental skills coach for the Queen's women's varsity basketball team, hopes her work will help account for the other 60 percent. She knows that school environment factors, such as having physical education specialists and facilities, might explain part of it. What remains to be answered is how school policies, programs and facilities influence student physical activity while considering individual characteristics. The answer has wide-ranging implications in areas as diverse as education, public health and urban design.

"What I want to get out of this is more effective school policies and programs to help children become more physically active," explains Jennifer, who is working with co-supervisors Dr. Lucie Levesque and Dr. Janice Deakin. "It's important that we give children a good foundation for a healthy life by making schools and neighborhood communities a better place for them. Politicians seem to be talking about it, but actual changes seem to be slow. Changing that situation is what motivates me."

▼ Grad student Jennifer Robertson-Wilson's work with youth and schools on activity levels will make communities stronger and healthier.

funding profile

◗ Social Sciences and Humanities Research Council Doctoral Fellowship (per annum)	$21,000

Queen's UNIVERSITY

Understanding Health Surveillance

After the SARS crisis of 2003, the Canadian government sponsored a comprehensive study of the country's public health system. The study recommended an overhaul of the public health system and led to the creation of the Public Health Agency of Canada. It also fostered an increasing emphasis on health surveillance—the collection, analysis and dissemination of national health data to help policy-makers direct appropriate resources to those areas of public health that require co-ordinated national attention.

Part of this job involves deciding how to gather public health and epidemiological data from the provinces—each of which has its own data-collection systems and processes—and how to consolidate it at a national level. It is a massive and complex task with enormous potential to improve the tracking and control of disease. Because of privacy concerns, it's also highly sensitive.

But to Martin French, a Queen's graduate student co-supervised by Dr. David Lyon and Dr. Myra Hird in the Sociology Department and Dr. Jacalyn Duffin in the History Department, what is interesting about the restructuring of the public health system is how the transformation of health surveillance will impact different social groups. He is specifically concerned that the identification of disease in the general population may lead to increased discrimination of already marginalized groups such as indigenous peoples, immigrant communities and low-income people.

The history of HIV/AIDS is a case in point: when the disease first emerged in North America in the early 1980s, it was generally considered a threat to gay men only. As knowledge about the disease grew, so did the numbers of social groups affected—and often stigmatized—by it. Martin would like to illuminate how this happens and, further, how it affects everyday conceptions of what it means to be healthy.

"There's a sense in which the spread of a disease is connected to our looking at it," he says. "I'd like to know how the health surveillance under Canada's restructured system affects the way we understand the health of Canadians."

▼ Grad student Martin French is investigating how surveillance systems change our perceptions of disease and marginalize social groups.

funding profile

- Social Sciences and Humanities Research Council
  - —Graduate Scholarship $35,000
  - —Surveillance Project $16,500

Queen's UNIVERSITY

Mildly Depressed? You May Be Better at Reading Emotions

Although it is a widespread and commonly discussed disorder, there remain many unanswered questions about the underlying causes of depression. But a recent study by Queen's researchers provides some tantalizing clues to advancing our understanding of depressive illness.

Psychology professors Kate Harkness and Mark Sabbagh—in collaboration with Prof. Jill Jacobson, students Neeta Chowdrey and Tina Chen, and colleagues from the Providence Continuing Care Centre—have discovered that people with mild depression are actually more attuned to the feelings of others than people who aren't depressed.

"This was quite unexpected because we tend to think that the opposite is true," says Prof. Harkness. "For example, people with depression are more likely to have problems in a number of social areas." In previous related studies conducted by members of the Queen's team on people diagnosed with clinical depression, participants performed much worse on tests of mental state decoding than people who weren't depressed.

To explain the apparent discrepancy between those with mild and clinical depression, the researchers suggest that becoming mildly depressed can heighten concern about your surroundings. "People with mild levels of depression might be especially motivated to scan their environment in a very detailed way, to find subtle social cues indicating what others are thinking and feeling," says Prof. Harkness.

The idea that mild depression differs from clinical depression is a controversial one. Although depression is often viewed as a continuum, Prof. Harkness believes that it may contain thresholds. "Once you pass the threshold, you're into something very different," she says.

Psychology Prof. Kate Harkness (far right) and graduate student Lisa Lee monitor lab co-ordinator Kelly Anthony-Brown in a "mental state decoding" exercise

funding profile

Canada Foundation for Innovation	$123,200
Ontario Innovation Trust	$123,200

Queen's UNIVERSITY

Mobile Fetal Alcohol Syndrome Test Heading out to Ontario Communities

Queen's University researchers have developed an innovative and comparatively inexpensive eye movement test that may help to diagnose children with Fetal Alcohol Spectrum Disorders (FASD). Health-care professionals currently rely on behavioural tests to assess children with developmental disorders, but until now there have been no objective diagnostic tools that can be used to distinguish between children with FASD and those with other disorders, such as Attention Deficit Hyperactivity Disorder (ADHD).

"There is a clear need for tools that can be used to reliably and objectively measure the brain injury of FASD," says Prof. James Reynolds of the Department of Pharmacology and Toxicology. Working with graduate student Courtney Green and colleagues from the Centre for Neuroscience Studies, Prof. Reynolds developed the pilot study that put eye movement assessment in FASD children to the test. Believed to be the first of its kind worldwide, the new test evaluates whether these children can control their eye movements following simple instructions and in response to different stimuli. "Now we can begin to identify and address specific deficits in these children."

Many of the behavioural tests used to assess children with FASD were developed for middle-class, English-speaking people, adds Courtney. "One of the biggest problems [in current tests] is cultural insensitivity," she says. "By measuring eye movements we can cut across cultural barriers and provide objectivity in identifying the disorder."

The next stage of the research will bring the test to remote Ontario communities with the help of a mobile-testing unit. "There are regions and communities in Ontario where FASD is more than a problem," notes Prof. Reynolds, "it's a tragedy. By moving this research program into communities across Ontario, we hope to provide an important new tool for diagnosis and for objectively evaluating the impact of therapeutic interventions." Improved diagnosis will better enable parents and health-care providers to access existing support systems, reducing the emotional and financial burdens associated with FASD.

Prof. James Reynolds checks as graduate student Courtney Green adjusts an eye-tracking device on control subject, Taylor Reynolds.

funding profile

- Canadian Institutes of Health Research $5000
- Ontario Graduate Scholarship in Science and Technology $15,000

Queen's UNIVERSITY

Arctic Warming Wake-Up Call

Unprecedented and maybe irreversible effects of Arctic warming, linked to human intervention, have been uncovered by a 26-person team of international researchers led by Queen's biology professor John Smol, **Canada Research Chair** in Environmental Change, and Prof. Alexander Wolfe of the University of Alberta.

In the largest study of its kind, the researchers, including Queen's biology research scientist Dr. Kathleen Rühland and PhD student Bronwyn Keatley, have found dramatic new evidence of climate changes across an area encompassing five circumpolar countries, extending halfway around the world and 30 degrees of latitude spanning boreal forest to high arctic tundra ecosystems.

The new study shows that climate change has lengthened growing seasons and reduced lake ice cover across much of the Arctic. "The timing of the changes is certainly consistent with human interference, and one of the major avenues is through climate warming," notes Dr. Rühland.

"This is an important compilation of data that human interference is affecting ecosystems on a profound scale," says Prof. Smol, who compares this study to viewing an impressionist painting, where looking at one small section may only reveal dots but on stepping back you see the whole picture. "Once you compile the larger dataset of all these lakes and ponds, striking and consistent patterns become evident. Taken together, it's a very powerful message."

"The tide has turned," he adds. An earlier lake sediment study co-authored by Prof. Smol in 1994 caused controversy with its interpretation of climatic warming in three high Arctic ponds. Now, he says, "some of the strongest skeptics of that study are co-authors on this paper."

▼ Queen's members of the international research team whose study shows "unprecedented" Arctic climate changes (left to right): PhD student Bronwyn Keatley, Dr. Kathleen Rühland and Prof. John Smol.

funding profile

- **National Sciences and Engineering Research Council**
  - **—Discovery Grant** $200,000
  - **—Northern Supplement** $10,000
- **Polar Continental Shelf Project** $20,000
- **Northern Scientific Training Program** $6,000

RYERSON UNIVERSITY

Dr. Ida Berger is researching the charitable patterns of some of Canada's largest ethnic groups.

Engaging Ethnic Communities in Voluntarism

Ida Berger, Associate Director of Faculty Affairs and Professor at Ryerson University's School of Business Management, is studying the reasons why ethnic populations tend to volunteer less. With funding from the **Social Sciences and Humanities Research Council**, Dr. Berger hopes her study will help volunteer organizations recruit and maintain support from ethnic communities.

Her research focuses on the Chinese and South Asian communities—two of the fastest-growing communities in Toronto. Working with Ryerson colleagues Drs. Mary Foster and Agnes Meinhard, Dr. Berger is investigating why these two groups were identified by the National Survey of Giving, Volunteering and Participating as volunteering less than other ethnic groups. Is it because community members are not fully integrated into Canadian society? Or, do barriers such as language, community access and access to information prevent greater participation? Because social integration is common to all ethnic and immigrant groups, Dr. Berger believes her research findings on the Chinese and South Asian communities will apply to other communities as well.

The team has begun to discover several reasons for the communities' lack of volunteering—the simplest being "nobody asked." Dr. Berger says, "It's not that they're less inclined to give; it's that they're kind of invisible to the voluntary sector."

funding profile

- Social Sciences and Humanities Research Council — $49,700

RYERSON UNIVERSITY

Signals of the Future

Sridhar (Sri) Krishnan, Chair of Ryerson University's Electrical and Computer Engineering Department, helms astonishing projects in the field of biomedical and multimedia signal processing.

His Signal Analysis Research (SAR) project is a wide-ranging research initiative made up of two subgroups: miSAR and MISAR. The first part, miSAR, studies the physiological sounds emitted by the body. This study could enable a physician, for example, to analyze the human voice and diagnose throat cancer with 95 percent accuracy.

The second part, MISAR, focuses on creating intelligent Internet search engines that scan the content of a page, rather than individual words. MISAR is already used to embed and hide watermark messages in multimedia content.

In another research direction, Dr. Krishnan's Time Frequency Distribution (TFD) project is exploring new ways to predict and determine time, specifically the spectrum in between time's high and low points.

Knee injuries, for example, could benefit from TFD analysis. Traditionally, a knee injury is diagnosed through arthroscopy, an invasive procedure "where the cartilage surface is inspected with a fibre-optic probe," says Dr. Krishnan. TFD would enable the doctor to visualize the frequencies emitted by the knee bending and unbending and discover the exact angle of the injury, thereby eliminating the need for arthroscopic surgery for diagnosis.

Dr. Krishnan mentors seven master's students and two PhD candidates. Since the graduate program began in 2001, three of his students have won "Best Paper" awards at international conferences, and one was honoured with the Governor General Gold Medal for his work on watermarking music files.

Dr. Sri Krishnan's research into time frequency may offer a less invasive way to diagnose knee injuries.

funding profile

- Natural Sciences and Engineering Research Council $95,000
- Communications and Information Technology Ontario (Ontario Centres of Excellence) $28,000
- Microelectronic Network $42,000

RYERSON UNIVERSITY

Slowing Down a Killer Virus

In a perfect world, a single pill would stop HIV from multiplying and causing AIDS.

Unfortunately, science hasn't found such a treatment, yet. So researchers such as Mario Clemente Estable, Assistant Professor in Ryerson University's Department of Chemistry and Biology, are working hard to find a cure for the 40 million HIV-positive people worldwide.

HIV enters the body and integrates with a person's DNA. Similar to a photocopier, the infected cells then produce billions of copies of the virus every day. As more and more cells are infected, the body's immune system is destroyed, resulting in the development of AIDS.

In tests, Major CDK9 Elongation Factor (MCEF)—a protein cloned and named by Dr. Estable—has demonstrated the ability to repress HIV replication by 50 percent. Slowing down this duplication process would enable the body to kill the remaining infected cells on its own.

Inside his Molecular Retrovirology Laboratory, Dr. Estable and his team of two graduate students are attempting to determine how MCEF functions, binds and interacts with DNA.

Although existing medications also hinder HIV replication, history shows the virus inevitably mutates and becomes drug-resistant. Dr. Estable and his team intend to modify MCEF with the flexibility to target all mutated HIV strains.

Dr. Mario Clemente Estable has discovered a protein that can slow HIV.

funding profile

- Natural Sciences and Engineering Research Council $115,000
- Canada Foundation for Innovation $60,000
- Ontario Innovation Trust $60,000
- Canadian Foundation for AIDS Research $24,973

RYERSON UNIVERSITY

You Are What You Wear

Ask any married woman what she cherishes most in her wardrobe and she will likely say her wedding gown. Although worn only once, that dress above all others is the most special. Clothes reveal a lot about who we are, whether it's a tailored suit for the office or a pair of sweatpants for a Sunday afternoon at home.

Kathryn Church of Ryerson's School of Disability Studies knows this well: her mother has sewn wedding dresses for women in her small Alberta community for over four decades. Exploring her mother's work led Dr. Church to think about the role clothing plays in contemporary social relations. With funding secured from federal and provincial resources, she launched Into and Out of the Closet: Discovering the Lifeworlds of Disabled Women Through Their Clothing.

"[The concept] hit me like a ton of bricks," says Dr. Church. "Why am I thinking that clothing has nothing to do with disability? Every person with a disability has to get dressed in the morning like everybody else. The idea was that I could bring those two together in a way that had never been done before."

To gather data for her project, Dr. Church will interview approximately 100 women with disabilities over the next three years to learn what their clothing says about their place in society. By exploring the women's closets and listening to their stories, Dr. Church hopes to gain insight into how women with disabilities present themselves to a world that may not welcome their different bodies.

"What I am attempting to do as a researcher is profile the expertise of people with disabilities from various walks of life about 'the way things work' across a range of circumstances and environments in which they live and work," says Dr. Church. "Among other things, my goal is to contribute to a broader, more complex and less stereotypic view of disability."

Dr. Kathryn Church is studying the politics of clothing among women with disabilities.

funding profile

◗ Social Sciences and Humanities Research Council (SSHRC)	$72,913
—SSHRC with the University of Toronto	$141,720
◗ Human Resources and Social Development Canada	$292,309
◗ Ontario Ministry of Citizenship and Immigration	$24,591

RYERSON UNIVERSITY

Prof. Filiz Klassen believes fabrics could be the building materials of the future.

Futuristic Fabrics Could Change How—and Where—We See Housing

Imagine a room that changes colour with the temperature. When it's warm, the walls glow vibrant red and when it's cool, crimson fades to icy blue. The walls also maintain an imprint of those who occupy the room. Although it sounds like the work of a science fiction writer, this idea is actually being explored by Filiz Klassen of Ryerson's School of Interior Design. By investigating innovative and lightweight fabrics, she aims to prove these materials can provide the world with new ways of inhabiting space. These alternative fabrics could be used in permanent or temporary architectural structures, and would meet the needs of our on-the-go culture, which demands that spaces be more adaptable, environmentally friendly and responsive to our needs.

Prof. Klassen hopes to realize those possibilities through her research project Malleable Matter: Material Innovations in Architecture, a three-year initiative sponsored by the **Social Sciences and Humanities Research Council**.

Prof. Klassen is producing a life-sized architectural structure made of fabrics blended with glass, metal, carbon and ceramics. When the project is complete, the material prototypes and resulting spaces will be showcased in a catalogue and exhibition.

Flexibility is a key element in Prof. Klassen's experiments with new materials. At the moment, she explains, our built environment is fixed. But if we found building and material options that made the assembly of habitable structures quick, easy and adaptable, Prof. Klassen believes our lives would no longer be defined by hard, permanent spaces.

To find that kind of adaptability, she is investigating how innovative fabrics could become the building materials of the future. While other researchers have chosen to develop new materials for fashion and jewellery, Prof. Klassen is one of the first to focus on architecture.

"I think as human beings we absolutely deserve the best spaces we can inhabit."

funding profile

Social Sciences and Humanities Research Council	$197,740

RYERSON UNIVERSITY

A Life Less Complicated—Improving Decision-Making in Complex Systems

Aziz Guergachi wants to make the world a simpler place. The professor at Ryerson's School of Information Technology Management (ITM) is studying complex systems to help those who manage and use them to make better decisions.

The stock market is an example of a complex system. Stock prices are influenced by a multitude of factors, including company profits, dividends, business investment, speculation and supply and demand. Due to the market's variables, it is difficult to accurately predict its value.

Currently, the behaviour of complex systems is not completely understood. Although many modelling technologies exist—neural networks, fuzzy logic, chaos analysis and catastrophe theory, among others—they all have limitations. Dr. Guergachi hopes to integrate these technologies into a universal model that can explain the behaviour of all complex systems.

With a PhD in engineering and undergraduate degrees in systems engineering and pure mathematics, Dr. Guergachi's interdisciplinary research focuses on three diverse systems found in business management, engineering and social science.

By applying business management systems to the manufacturing and retail sectors, a better understanding of trade promotion systems could improve return-on-investment and competitiveness.

In the biological treatment of wastewater, an accurate model could enable plant managers to meet operating standards, improve their bottom line, protect the environment and preserve the health of the community.

And a social science model to express human emotions could benefit both people with disabilities and decision-makers in general. Here, Dr. Guergachi and fellow Ryerson ITM researchers have developed an application to translate the emotional content of movies into signals that can be interpreted by people with visual or hearing impairments.

In analyzing these three diverse systems, Dr. Guergachi hopes to discover their hidden commonalities and, ultimately, a universal model for all complex systems.

Dr. Aziz Guergachi is focusing his research on ways to understand complex systems.

funding profile

- Natural Sciences and Engineering Research Council $108,000
- Canada Foundation for Innovation $60,000
- Ontario Innovation Trust $60,000

UNIVERSITY of TORONTO

Training the Next Generation of Researchers

Do teenagers speak a language of their own? Yes, says Sali Tagliamonte, Professor of Linguistics at the University of Toronto. She is studying the speech patterns of kids ages nine to 19 and adding valuable insight into how the English language is evolving.

But, admits Prof. Tagliamonte, observing this population up close is next to impossible for herself, a 44-year-old mother. This is why the Research Opportunity Program (ROP)—a U of T initiative that pairs undergraduate students with research faculty—is a gold mine.

"These students are 19 or 20 years old and exponentially closer to this population than I am. They can talk to teenagers in a way that taps into their unique variety of speech at its most relaxed."

Every year, Prof. Tagliamonte enlists four or five students through the ROP and has them interview their younger relatives or neighbours. The students then help with all aspects of research administration—transcribing notes, managing the database and analyzing the material to identify patterns in speech. "They learn how a research program works from beginning to end. So it's really a win-win situation."

Jonille Clemente, a fourth-year undergrad who has worked with Prof. Tagliamonte for three years, agrees. "The program allows you to see beyond the theory, which is what most undergraduate courses are about. Coming out of first year, it was great to be able to do this kind of hands-on work. I will definitely cherish the experience."

▼ Prof. Sali Tagliamonte is studying how adolescents speak.

Photo: Liam Sharp

funding profile

Social Sciences and Humanities Research Council	$211,403
Connaught Fund	$10,000

UNIVERSITY of TORONTO

Land Use and Global Warming

Jing Chen's knowledge of global warming has taken him from the classroom to the other side of the world. A Geography Professor at the University of Toronto, Dr. Chen is also the Canadian Director of China Carbon Sequestration, a group examining land-use change and China's carbon cycle.

Carbon is a building block for all matter on earth—an essential ingredient for healthy soils. But when released into the atmosphere as carbon dioxide, it becomes a greenhouse gas that contributes to global warming. The process of sequestering carbon to terrestrial locations such as plants and soil prevents it from collecting in the atmosphere as carbon dioxide. Forests break down carbon dioxide during photosynthesis, absorb the much-needed carbon and release oxygen into the atmosphere.

Using Canadian ecosystem models, instruments and remote-sensing technology, Dr. Chen and researchers from U of T and institutions in Beijing, Nanjing and Lanzhou are helping China increase its ecosystem carbon stocks through more informed and effective land use, forest management and policy-making.

"Our research outcomes could potentially impact China's policies related to climate change," explains Dr. Chen. "The results from China will also increase our understanding of the global carbon cycle."

Dr. Chen, who is also a **Canada Research Chair** in Ecosystem-Atmospheric Interaction, leads a team of seven graduate students and three postdoctoral fellows in this study of regional and global carbon cycles. The team is making scientific strides in proving that environmentally sound land management can be a reality.

At home, Dr. Chen is conducting further carbon-related study at one of Fluxnet-Canada's research network sites. Funded by the **Natural Sciences and Engineering Research Council**, Fluxnet-Canada is a network of 44 co-investigators from 13 universities, two federal government departments and three provincial research institutes who, collectively, are examining the role of Canadian ecosystems in the global carbon cycle.

▼ Dr. Jing Chen uses an instrument he invented to measure leaf area.

Photo: Liam Sharp

funding profile

◗ Canada Research Chair	$1.4 million
◗ Natural Sciences and Engineering Research Council	$342,320
—subgrant (Université Laval)	$87,676
◗ Canadian Foundation for Climate and Atmospheric Sciences	
—subgrant (Université Laval)	$161,413
◗ Networks of Centres of Excellence	$53,200
◗ Natural Resources Canada	$148,000
◗ Canadian International Development Agency	$2.1 million
◗ Public Works and Government Services Canada	$50,000
◗ Canadian Foundation for Climate and Atmospheric Sciences	$407,005
◗ Canadian Forest Services	$102,850
◗ Premier's Research Excellence Award*	$150,000
◗ Connaught Fund	$10,000

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

UNIVERSITY of TORONTO

Photo: Liam Sharp

▼ Dr. Ray Carlberg studies the period of time when galaxies first began forming.

Beyond the Stars

Ray Carlberg's research allows him to look far beyond the reach of most telescopes into the recesses of distant galaxies. But it's back on terra firma where the professor of astronomy and astrophysics unravels grand mysteries—namely, how the universe was formed and how it continues to evolve today.

Dr. Carlberg is the principal investigator of the Canadian Network for Observational Cosmology, where he leads large-scale surveys of distant galaxies to uncover new information about the formation of star systems. As U of T's lead investigator in the Toronto Carnegie Magellan Observatory Collaboration, Dr. Carlberg is developing the tools to study distant galaxies as well. The Magellan twin telescopes, able to shoot 1,000 galaxies at once, offer unprecedented access to data and brand new views of the cosmos.

Dr. Carlberg is also an integral part of the Thirty Metre Telescope (TMT) project—the largest telescope ever built. Funded through a private-public partnership that involves groups from both Canada and the United States, the TMT will be fully operational by 2015 and will offer scientists an unprecedented opportunity to explore the early universe.

Undergraduates who join Dr. Carlberg's team participate in a variety of projects. Engineering students, for example, have undertaken an analysis of how to build a massive spectrograph that can disperse light into its colours. Astronomy students are conducting a preliminary assessment of the best mountains on Ellesmere Island to set up a future observatory. "This work is for a future telescope but usefully taps into the tremendous site-testing knowledge of TMT," explains Dr. Carlberg.

Graduate students usually undertake longer-term projects. "One of our students designed integrated modelling to do an end-to-end analysis of the performance of TMT. And another has undertaken the detailed modelling of the scientific performance of specific instruments."

funding profile

◗ Natural Sciences and Engineering Research Council	$3.3 million
◗ Canada Council for the Arts (Killam Fellowship)	$148,157
◗ Canada Foundation for Innovation	$2 million
◗ Ontario Research Fund – Research Infrastructure	$2 million
◗ Ontario Innovation Trust	$1.3 million

UNIVERSITY of TORONTO

Dr. Rinaldo Walcott is challenging traditional views of Canadian culture.

Photo: William Ciccocioppo

The Cultural Explorer

Rinaldo Walcott seeks new definitions of Canadian culture.

He started his career in rap music. Not as a rapper—or a musician at all—but as a social scientist quietly working on his PhD.

As a graduate student at the Ontario Institute for Studies in Education of the University of Toronto, where he is now an associate professor and a **Canada Research Chair** in Social Justice and Cultural Studies, Dr. Walcott was exploring how rap music in the early 1990s was emerging as an important social and political force.

That research prompted him to examine literature, film and other types of music as windows into contemporary black Canadian culture—work that culminated in a critically acclaimed collection of essays called *Black Like Who?*

Today, he is developing a web-based archive of films and short videos that challenge traditional notions of Canadian culture.

"We are interested in work that re-narrates the Canadian nation," he explains, referring to his search for films developed by "people who are set apart from the dominant culture by racial, ethnic, gender and/or sexual difference."

Graduate students are an indispensable resource for developing his database, and Dr. Walcott also appreciates the diverse perspectives they bring to the table. "My students, who are studying everything from erotic performance to Asian women and contemporary popular culture, really inform my own work because it is so interdisciplinary."

Drawing a great deal on the programs of fringe film festivals, Dr. Walcott's database adds important new voices to the Canadian narrative. "We think it will have a real impact on how people actually think about cultural production and the role it plays in shaping people's identities, and in shaping Canadian culture more broadly."

funding profile

Canada Research Chair	$500,000
Canada Foundation for Innovation	$100,000
Ontario Innovation Trust	$100,000

UNIVERSITY of TORONTO

Managing Risk: Math Research has Significant Impact on Banking Industry

A passion for problem-solving and an eye for opportunity inspired Luis Seco to tackle the challenges faced by some of Canada's largest banks.

A professor of mathematics, Dr. Seco delivers risk management solutions to the financial sector from RiskLab, an innovative centre he established in 1996 at the University of Toronto at Mississauga (UTM) in collaboration with Ontario-based software developer Algorithmics Inc.

RiskLab's unique use of mathematics and statistics to navigate uncertainty in financial markets has been replicated at eight universities around the globe—the sincerest form of flattery.

This RiskLab network has allowed Toronto expertise in energy sector risk management to make it to Germany. In turn, Spanish experience has enabled Toronto's RiskLab to collaborate with a software company to offer banks a certificate program in the emerging field of operational risk management.

While developing solid industry relationships and generating income for the university, RiskLab has also established an outstanding research and training platform for faculty and graduate students at U of T. "It's a very reciprocal relationship," says Dr. Seco. "Our clients tell us what the problem is and we tell them what the solutions may be. Then we can publish and obtain research results and produce PhD theses, and they can build their products or enhance their services."

The success of UTM's RiskLab is reflected in a variety of commercial contracts, and is also evident in the many spin-offs of excellent student research—most notably Sigma Analysis & Management Ltd., which advises investors on the use of hedge funds to avoid economic shocks.

Photo: Liam Sharp

Dr. Luis Seco's research delivers risk management solutions to the financial sector.

funding profile

- Natural Sciences and Engineering Research Council $150,000
- Networks of Centres of Excellence (MITACS) $20,000

UNIVERSITY of TORONTO

Photo: Liam Sharp

▼ Dr. Maydianne Andrade's research focuses on the Australian redback spider.

Research with Eight Legs: Spiders Put Evolutionary Theory to the Test

Maydianne Andrade's laboratory at the University of Toronto at Scarborough is crawling with spiders—specifically Australian redback spiders, close relatives of the black widow. But it is not an unwanted infestation. Dr. Andrade's spider community and her research into their mating habits are bringing her and the University of Toronto Scarborough worldwide acclaim.

In 1996, her pioneering work on redback spiders' bizarre mating rituals was published in the prestigious journal *Science*. And in 2005, Dr. Andrade was named one of *Popular Science* magazine's Brilliant 10 young scientists in North America.

What is this "bizarre mating ritual?" The male redback spider deliberately positions himself over his lover's fangs—while still copulating—and is then eaten by his partner. Other scientists have proposed that the males sacrifice themselves to literally feed their future offspring, but Dr. Andrade has proven their suicidal behaviour is an act of self-interest, allowing them to copulate longer and fertilize more eggs.

While she focuses on spiders, Dr. Andrade's work has broader applications to the science of life. "We are trying to inform the larger question of how evolution actually works," she says. "Evolutionary theory says animals are more concerned with maximizing their reproductive output than ensuring their survival. It isn't enough to say that 60 or 80 per cent of animals behave in ways that are consistent with evolutionary theory. We need to know if extreme mating systems can also be explained by this theory."

Dr. Andrade's work also keeps a team of talented graduate students busy with research that is winning plaudits from the scientific world. The research of MSc student Lindsay Snow, for example, was published in the renowned *Proceedings of the Royal Society of London*. And PhD candidate Michael Kasumovic won the President's Prize at the Entomological Society of Canada conference in 2006.

funding profile

Natural Sciences and Engineering Research Council	$72,000
Premier's Research Excellence Award*	$150,000

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

TRENT UNIVERSITY

Researching Global Change Biology at Trent University

Marguerite Xenopoulos is leading the way in research on global change biology.

The Trent University Biology Professor has created a laboratory to conduct research on the effects of environmental stressors on water quality and biodiversity. These stressors include climate change, ultraviolet radiation, acidification of waterways, water consumption and land-use change.

Prof. Xenopoulos is currently participating in a province-wide research initiative by the Ontario Ministry of Natural Resources to determine the effects of climate change, hydro power and dams on lake water-levels.

Graduate student Michael White is helping Prof. Xenopoulos examine how changes in annual lake levels, in turn, alter biological processes near the shoreline.

Preliminary results show that the level of a natural lake fluctuates within one metre each year but the level of a reservoir may fluctuate more than 10 meters in one day.

"The fluctuations in water levels in reservoirs appear to have a huge impact on aquatic biodiversity, fisheries and potentially on water quality," says Prof. Xenopoulos. "In the next few years, we will gather enough information to make scientifically sound recommendations for water-level regimes in reservoirs and, ultimately, understand how future climate change may affect water levels in all standing water bodies."

Prof. Xenopoulos is also researching how agricultural land-use affects streams in south-central Ontario. She is studying 40 different streams, all of which have a different proportion of agricultural use within their catchment area ranging from zero to 90 percent. Graduate student Henry Wilson and a number of undergraduate students are assisting with this research.

"We found the higher the percentage of agricultural land, the higher the concentration of pollutants, organic matter and nutrients flowing into nearby streams. And in most cases, streams with more agricultural land-use around them had more nitrogen and phosphorus in the water. These materials have a strong effect on organisms living in and adjacent to the streams."

Prof. Xenopoulos feels it is important to have graduate students assist with her research.

"I work on so many drivers that it gives students many opportunities to develop their own ideas. Then they are happier with what they are doing, which works better for everyone."

▼ Prof. Marguerite Xenopoulos is working with undergraduate and graduate students to research the effects of environmental stressors on water quality.

Photo: Pascal Paquette

funding profile

Natural Sciences and Engineering Research Council	$115,000
Parks Canada	$22,000
Canada Foundation for Innovation	$132,591
Ontario Research Fund —Research Infrastructure	$132,591
Ontario Ministry of Natural Resources (through Watershed Science Centre)	$100,000

University of Waterloo

Making Research Work

Research Works! That's the name of a multi-faceted educational program designed to improve children's literacy skills through collaborative research initiatives. Directed by Kathleen Bloom of the University of Waterloo's Department of Psychology, it develops tools, techniques and resources to train, stimulate and carry out literacy-focused research.

Multilateral partnerships, teamwork and student research projects that bind theory to practice are the driving force behind the program's success.

Research Works! trains and funds the research of undergraduate and graduate students from across Canada in disciplines such as education, audiology, speech language pathology, psychology and human resources. Students share knowledge and resources and engage in teamwork through e-communities. In addition to academic advisors, they are guided by community partners with expertise in various areas of child literacy. Students also have the opportunity to participate in creating and using the research tools that connect community and university together.

A partnership with Frontier College, for example, enabled the program to summarize research evidence on how volunteer tutoring helps children struggling to learn to read and to host a workshop that helped college volunteers gain skills in finding and evaluating research evidence efficiently.

The program turned a research methods course at the university into an incubator for community projects for child development. It also created an international online catalogue of book-gift programs and supported a project to show how reading to children in day-surgery waiting rooms helps to reduce their anxiety.

Dr. Kathleen Bloom at Research Works! annual general meeting.

funding profile

- **Social Sciences and Humanities Research Council/ Community-University Research Alliance** $958,000
- **University of Waterloo/UW Office of Learning Resources and Innovation** $100,000

University of Waterloo

Evaluating the Effectiveness of Tobacco-Control Policies

Tobacco use is the leading cause of preventable death among adults worldwide. In the 21st century, an estimated one billion people will die of it—70 percent of them in low- and middle-income countries.

Geoffrey Fong, University of Waterloo Psychology Professor, is Chief Principal Investigator of the International Tobacco Control (ITC) Policy Evaluation Project, a collaboration of more than 40 researchers in nine countries.

The project evaluates policies of the Framework Convention on Tobacco Control, the first international treaty on health. Evidence supports ratification and implementation of the treaty worldwide.

Dr. Fong's studies have involved numerous graduate students including David Hammond, who recently became a Health Studies and Gerontology Professor at the university.

David works with Health Canada and others internationally to examine tobacco policies including the effect of graphic warning labels on cigarette packages. He also assisted the World Health Organization to develop ways of measuring and communicating cigarette toxicity.

The ITC project evaluated Ireland's 2004 smoke-free workplace law as part of its research.

"Eighty-three percent of smokers said the law was a 'good' or 'very good' thing," says Dr. Fong. "The Irish law has been a resounding success in protecting the public's health and is a model for the world."

Dr. Geoffrey Fong founded the International Tobacco Control Policy Evaluation Project to research tobacco issues on a global scale.

Dr. David Hammond evaluates the effectiveness of a range of tobacco-control policies.

funding profile

GEOFFREY FONG

- National Cancer Institute/ National Institutes of Health (U.S) — $12 million
- Canadian Institutes of Health Research — $1.8 million

DAVID HAMMOND

- Health Canada — $74,000
- Canadian Tobacco Control Research Initiative — $80,000

University of Waterloo

Life Sciences Research Targets Cardiovascular Disease

Research contributing to the prevention and treatment of cardiovascular disease is being conducted by James Rush at the University of Waterloo.

Holder of the **Canada Research Chair (CRC)** in Integrative Vascular Biology, Dr. Rush is examining the cellular and molecular basis for poor blood vessel function in hypertension and the benefits of exercise and dietary factors on this function.

Cardiovascular disease is the single leading cause of death in Canada. It is responsible for nearly 40 percent of deaths and results in about $20 billion annually in direct and indirect expenditures. Hypertension, or high-blood pressure, affects one in five Canadians and can increase the risk of cardiovascular disease by two to three times.

A common element of cardiovascular disease is the dysfunction of vascular endothelial cells that line blood vessels. While exercise, dietary and drug treatments can reduce this condition, it is important to understand the cellular mechanisms responsible for the dysfunction to identify potential targets for primary and secondary prevention.

His **CRC** funding has allowed Dr. Rush to commit more time and effort to his research and to attract top students and trainees. He supervises five graduate students and a postdoctoral fellow who attend international scientific conferences and publish their research in leading journals.

The infrastructure of the lab allows new collaborations with local, national and international laboratories, creating "unique training experiences for graduate students" as well as attracting many trainees from elsewhere.

Dr. James Rush holds the **Canada Research Chair** in Integrative Vascular Biology.

funding profile

Canada Research Chair	$500,000
Natural Sciences and Engineering Research Council	$88,240
Canada Foundation for Innovation	$317,263
Ontario Innovation Trust	$271,881
Ontario Ministry of Agriculture and Food	$600,000
Heart and Stroke Foundation of Ontario	$360,000
Industry	$94,196

University of Waterloo

Global Approaches to the Study of Great Lakes

The University of Waterloo's Robert Hecky is distinguished by both the results and the geographic range of his ecological research into freshwater lakes. His research projects have taken him from lakes north of the Arctic Circle to the Great Lakes of Africa and North America.

In 2003, his research on the effect of global warming on Africa's Great Lakes, assisted by grad student Pieter Verburg, was cited among the 10 most important advances in science for that year. And in 2006 Dr. Hecky was awarded the F.H. Rigler Award from the Canadian Society of Limnologists—the society's highest honour in the field of freshwater science.

Dr. Hecky is currently working with grad students on the Great Lakes of North America, evaluating the impact of invasive zebra mussels on phosphorus cycles and the re-emergence of the nuisance alga Cladophora. This alga can foul beaches in mid-summer, cause odours and potentially block the cooling-water intakes of Lake Ontario's nuclear plants.

The global reach of his grad students' research extends from Africa's Lake Victoria, Lake Malawi, East Africa Great Lakes and Lake Bosumtwi—an ancient crater lake in West Africa—to North America's Great Lakes, Huron, Erie and Ontario.

Dr. Robert Hecky and Ghanaian watchmen at the Bosumtwi Crater Lake meteorological station in Ghana.

funding profile

Natural Sciences and Engineering Research Council	$370,700
Canada Foundation for Innovation	$258,460
Ontario Innovation Trust	$198,815
Ontario Ministry of Environment	$91,770
Ontario Clean Water Agency	$376,679
City of Toronto	$75,000
University of Toronto	$93,116
International Development Research Center	$7,500

University of Waterloo

Medical Breakthrough to Identify Bacteria and Treat Infections

Pioneering work by the University of Waterloo's Susan Mikkelsen and former PhD student Peter Ertl has the potential to radically improve the response time of identifying and treating infectious diseases.

They have developed an advanced electrochemical technique that can identify an unknown bacteria and its most effective antibiotic match in less than 30 minutes—a vast improvement from the four to 72 hours offered by current technology. As a result, patients could be placed on more appropriate and effective antibiotics in record time. As well, hospitals could manage contagious disease and secondary infections with greater knowledge and improved efficiency.

Dr. Mikkelsen's and Peter's technology is based on a direct measurement of cellular activity that eliminates the need for long periods of bacterial growth. Today, doctors often begin treatment by prescribing expensive, wide-spectrum antibiotics because current susceptibility tests require two to three days. Once the results are available, the prescription is often changed. Quicker test results would provide a cost savings to the healthcare system and also improve patient outcomes and reduce mortality.

Dr. Mikkelsen and her team of graduate students often collaborate with different groups of UW researchers. Many initiatives are centred at Waterloo's state-of-the-art diagnostic and fabrication facility for the development of novel biotechnological, environmental and strategic materials.

Dr. Susan Mikkelsen with grad students.

funding profile

Natural Sciences and Engineering Research Council	$205.000

University of Waterloo

Research Has Impact on Health and Environmental Sectors

Janusz Pawliszyn, Chemistry Professor at the University of Waterloo, is pursuing research that will benefit both the health and environmental sectors.

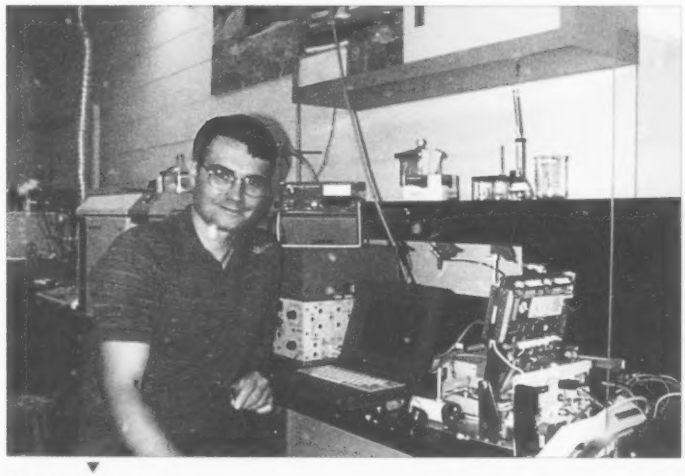
An internationally recognized inventor of solid phase micro-extraction, Dr. Pawliszyn is holder of the **Canada Research Chair** in New Analytical Methods and Technologies.

He is developing integrated and automated analytical methods and instrumentation for the on-site analysis and monitoring of biological and environmental systems. On-site technologies have the potential to reduce errors and expedite sample transport and storage, resulting in more accurate and timely analytical data.

With such a system, a doctor or nurse would be able to analyze the blood composition of a patient without drawing a blood sample. Instead, a micro-probe could selectively extract minute quantities of target analyses for the test. This would save time and eliminate the sometimes difficult and potentially harmful sample collections that occur in today's medical practices.

Through his research into the design of highly automated and integrated instrumentation, Dr. Pawliszyn aims to isolate analytes from complex matrices and subsequently separate, identify and determine these species.

Graduate students play a major role in assisting Dr. Pawliszyn. He currently supervises 25 students, including PhD candidates, master's students and a postdoctoral fellow.



Dr. Janusz Pawliszyn is developing new analytical methods and instrumentation for on-site analysis.

funding profile

Canada Research Chair	$1.4 million
Natural Sciences and Engineering Research Council	$1.9 million
Canada Foundation for Innovation	$124,295
Ontario Innovation Trust	$124,295
Industry	$1.4 million

Research Western

Cristina Badescu's work on human rights has earned her the **Social Sciences and Humanities Research Council's** Doctoral Fellowship Award and the 2005-06 Human Security Fellowship Award from the Canadian Consortium on Human Security.

Taking a Stand on Human Rights Protection

Fourth-year PhD student Cristina Badescu wants to know: when is military intervention the appropriate response to protect human rights? Assessing the feasibility and challenges of the 2001 International Commission on Intervention and State Sovereignty (ICISS) report—*The Responsibility to Respect* (R2P)—is an integral part of her research.

The R2P report looks at humanitarian military interventions that protect civilians from conflict and human rights abuses. Currently there is no established framework for how and when to engage the military because this kind of intervention is still a new issue with the ICISS. Cristina's continued interest in human rights raises the questions "What triggers intervention?", "Who should intervene?" and "Who actually has rights?" She hopes that her analysis of the report's recommendations, which favour military intervention, will develop a framework for translating concepts into law on an international level.

With further funding, Cristina plans to travel and interview prominent persons in foreign affairs—including the Canadian ambassador—as well as other scholars and officers to understand their thoughts on military intervention and its future role in society.

Upon graduation, Cristina would like to intern with the United Nations and focus her attention on human rights. Eventually, she hopes to become a policy analyst and put her research to practical use.

funding profile

Social Sciences and Humanities Research Council Doctoral Fellowship Award	$20,000

Research Western

Growth Beyond the Petri Dish

Sean Bendall, biochemistry doctoral student at The University of Western Ontario, is focusing his research on the growth conditions of human embryonic stem cells. He hopes his findings will help scientists better understand the molecular mechanisms that control the growth of these prolific and differential cells.

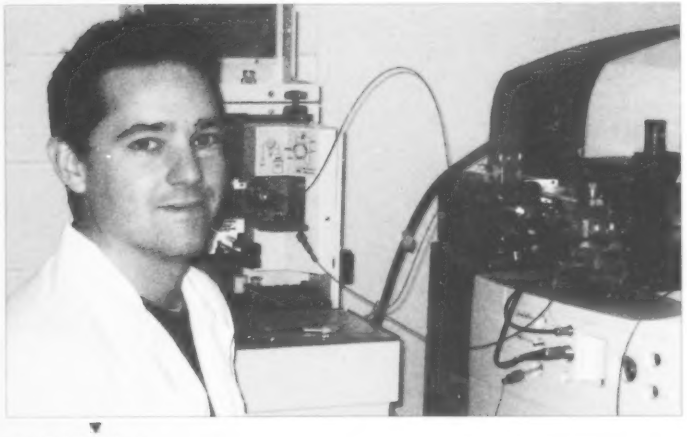
Sean pre-conditions the stem cells by inserting them in a culture media—a soupy substance that allows the cells to grow and hopefully reveal which protein growth factors affect cell populations. From there, he can develop new methods to characterize different cell colonies and specific cell types.

Dr. Mickie Bhatia—Sean's thesis advisor and a seasoned investigator in the field—hopes to further develop Sean's research for his own work into total organ or cellular regeneration—reconstructing tissue for a bone marrow replacement, for example.

While studying for his MSc at the University of Victoria, Sean also had the opportunity to study under Dr. Bob Olefsan, a nationally known professor in the field of biochemistry and microbiology. Working in the genome lab with Dr. Olefsan, Sean learned the necessary techniques that would lead him to Western.

Inspired by the facilities and technology available at Western, the Robarts Research Institute and the Siebens-Drake Research Institute, Sean says, "I found a hole in the field that needed to be filled."

He is confident that with Western's cutting-edge technologies, as well as the tremendous funding opportunities available from the **Ontario Research and Development Challenge Fund** and **Genome Canada**, he will be able to fill that hole and complete his PhD mission.



Grad student Sean Bendall is the recipient of the Canada Graduate Scholarship doctoral award, the largest award a PhD student can receive.

funding profile

◗ Canadian Institutes of Health Research annually, for three years	$35,000

Research Western

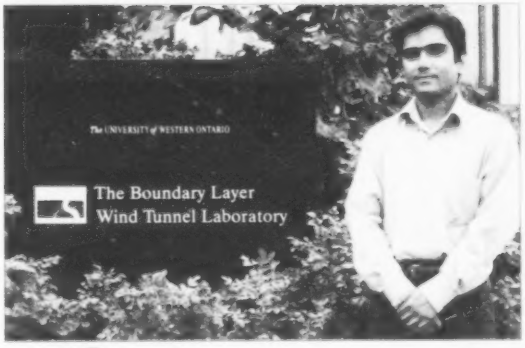
Engineering a Career in World-Class Research with the Three Little Pigs

Hurricanes Katrina and Rita—not to mention an increasing number of devastating weather events around the world—have prompted researchers to look at new ways to protect residential real estate. Second-year PhD student Tanweer Malik is part of the upcoming Three Little Pigs Project—a groundbreaking opportunity for civil and structural engineering students to learn how to assess the integrity of building components.

Researchers will apply tropical storm-strength wind to full-scale model houses—all within a controlled environment. Tanweer's role will be to predict the behaviour of the wood-framed house components and analyze the results once the wind loads have been transmitted. He calls it "looking for the weakest link."

After completing his master's at the University of British Columbia, Tanweer was asked to join the Three Little Pigs team by Mike Bartlett, one of the project's principal investigators. Tanweer readily seized the learning opportunity offered by both the uniqueness of the project and the cutting-edge technological environment funded by the **Canada Foundation for Innovation** and the **Ontario Innovation Trust**.

Upon graduation, Tanweer intends to apply his knowledge of structural design to help build more reliable buildings and houses. He also hopes that research findings from the project will improve future policies and regulations for the construction industry.



PhD student Tanweer Malik is studying the devastation that strong winds, rain and mould can bring to houses.

funding profile

PROJECT FUNDING

Canada Foundation for Innovation	$2.72 million
Ontario Innovation Trust	$2.72 million
Other	$1.4 million

Research Western

Pinning Name Tags on Proteins

While mapping the human proteome may sound futuristic to many, it's the cornerstone of research at the Dr. Don Rix Protein Identification Facility at The University of Western Ontario, a lab at the forefront of proteomics.

Proteomics—the study of systematically identifying and understanding cell protein function—evolved from the recent mapping of the human genome, the complete set of genetic information. The proteome includes all the proteins that exist in an organism throughout its life cycle. It differs from cell to cell and is constantly changing through the biochemical interactions between the genome and the environment. By mapping protein interactions within human cells, researchers are able to discover biomarkers, often indicators of particular diseases.

The facility was the first in the world to acquire a Fourier Transform Ion Cyclotron Resonance Mass Spectrometer with a 12 Tesla magnet. This new instrumentation enabled Western's Gilles Lajoie and his team to develop new methods for the identification of proteins in large numbers. In turn, this allowed the team to obtain precise snapshots of what takes place in cells. The group intends to apply this research to the design of new drugs.

Three graduate students and three postdoctoral fellows are currently working on studies of stem cells, preeclampsia and enzyme inhibition. "These researchers make a contribution on all levels, including the development of new technologies, and when they leave they are in high demand in the industry," says Prof. Lajoie.

Prof. Gilles Lajoie stands with the Fourier Transform Ion Cyclotron Resonance Mass Spectrometer.

funding profile

GILLES LAJOIE

◗ Natural Sciences and Engineering Research Council (annually 2002-2007)	$50,000
◗ Genome Canada	$68,973
—subgrant through University of Toronto	$147,608
◗ Merck Frosst (graduate student support)	$30,000

Prof. Silvia Mittler with images from Western's nano-fabriction laboratory.

Small Science—Big Ideas

Thanks to an innovative nanofabrication laboratory, researchers at Western are able to think big on a very, very small scale—the nanoscale, or one billionth of a metre.

Big ideas are being put to the test in the $23-million facility, which offers state-of-the-art equipment for fabricating nanostructures. Led by Silvia Mittler, Lab Director and **Canada Research Chair** in Photonics of Surfaces and Interfaces, most of the work at the laboratory is being conducted by undergraduate, graduate and postdoctoral students. They are all gaining valuable hands-on experience with leading tools in an ever-expanding—and ever-shrinking—area of research.

At the facility, students are given the opportunity to supplement basic knowledge in their respective fields with practical training on high-tech machinery. As the miniaturized nature of the work demands cleanliness—flecks of dust are generally larger than materials being fabricated and studied—students learn how to maintain the facility, operate the machinery and avoid certain activities.

The demand for nanotechnology is being driven by our information- and data-driven society and its need for faster, smaller and greater-capacity devices, explains Prof. Mittler. "There is an increasing move toward basic research on the nanoscale," she says, adding that researchers are able to use the technology for their work with every possible solid material class, from metals to semi-conductors to organic materials.

While the materials studied may be small, outcomes from the research promise to be enormous.

funding profile

NANOFABRICTION LABORATORY

◗ Canada Foundation for Innovation	$3 million
◗ Ontario Innovation Trust	$3 million
◗ Ontario Research and Development Challenge Fund	$5.2 million
◗ Other	$11.8 million

Research Western

Prof. Peter Hoaken thinks PDA technology will redefine social science research.

With potential support from the Early Researcher Award program, Prof. Hoaken intends to attract top graduate students and postdoctoral fellows and build his tech-friendly team to seven. His students will have the opportunity to study psychology in a practical, novel and innovative manner and learn to identify traits that predispose individuals to maladaptive behaviours. Dr. Hoaken hopes this research will lead to new education programs that assist the health-care system both directly and indirectly.

Funded by the **Canada Foundation for Innovation** and the Alcoholic Beverage Medical Research Foundation, data collected from the study will also provide colleagues with insight into other behavioural issues unrelated to alcohol.

The Answer Could Be in Your Palm

Personal Digital Assistants (PDAs) have already infiltrated boardrooms and classrooms; now they are helping university researchers study human behaviour.

"Technology is going to allow social sciences researchers to do amazing things in the coming years," says Western Psychology Prof. Peter Hoaken, who is using PDAs to explore ties between alcohol and a variety of health-related behaviours, including aggression and unsafe sex.

Study participants are asked a series of questions through a PDA to assess behavior, mood and cognitive abilities—whether they have consumed alcohol or not. "The innovative aspect is to get results from people in their natural environments," he says of the process, coined "experience sampling." Real-time responses help eliminate biases associated with traditional methods and, because of the disinhibiting nature of alcohol, hopefully result in more truthful replies.

funding profile

PETER HOAKEN

Social Sciences and Humanities Research Council	$72,427
Canada Foundation for Innovation	$81,587
Ontario Research Fund —Research Infrastructure	$81,587
Alcoholic Beverage Research Foundation	$62,600

Wilfrid Laurier University

Building Social Inclusion for Lone Mothers

Lea Caragata feels Canada has developed a punitive welfare system.

As the principal investigator on a $1 million national research project, Dr. Caragata is studying recent changes in the labour market that offer lone mothers fewer secure jobs at liveable wages and a social services system that is replacing welfare with workfare.

"In Canada we have not had a comprehensive, national examination of how these two factors intersect since these changes began in the 1990s," says Dr. Caragata, Associate Professor of Social Work. "A unique set of conditions is affecting one of Canada's most vulnerable population groups."

The research project, entitled Lone Mothers: Building Social Inclusion, uses a social inclusion/exclusion lens to explore a range of factors that contribute to the experiences of lone mothers. Along with labour and welfare issues, the project seeks to explore racialization and immigration, spatially concentrated poverty, housing, and health and well-being—all multiple dimensions of social exclusion.

According to Dr. Caragata, "We no longer allow lone mothers to stay at home. At the same time, their employment options are more limited, often to what are called "McJobs," or non-standard work characterized by low pay, no benefits and irregular hours of work."

Twenty-one investigators, representing five universities and seven social service agencies, will spend the next five years on the project, through different studies undertaken in Halifax, Toronto and Vancouver.

Dr. Caragata's goal is to influence the development of policies and practices that directly address the real needs of lone mothers.

▼ Dr. Lea Caragata is focusing her research on recent changes to the welfare system.

funding profile

▸ Social Sciences and Humanities Research Council	$1 million

Wilfrid Laurier University

Uncovering Music Theory from the Middle Ages

Alma Santosuosso, Professor of Musicology at Wilfrid Laurier University, is researching mediaeval music theory in Normandy, France, through codicology—the study of manuscripts as cultural artifacts for historical purposes.

"The basis for understanding Western music comes from studying music theory, which is the grammar of music, but we don't know how people studied music in the past," says Dr. Santosuosso. "During the Middle Ages, music was one of the subjects of the educational curriculum of the seven liberal arts. By studying the surviving music theory manuscripts, a clear idea emerges of how music was studied at specific institutions."

Her current research focuses on 16 surviving music theory codices, dating up to 1300, from seven Norman monasteries.

"The study of music at Norman monasteries in the Middle Ages has never been undertaken," she says. "My goal is to provide a codicological, historiographical and bibliographical analysis of the surviving codices."

Dr. Santosuosso analyzes the codicological features of each manuscript including date, provenance, size, numeration and collation of the gatherings, scribal hands and layout, and decoration.

"The results so far have been surprising. The diverse theoretical writings found in the surviving manuscripts points to Normandy as a very important centre for the study of music theory during the Middle Ages," she says.

Dr. Santosuosso plans to write a third book in her series *Music Theory in Mediaeval Normandy*, based on her latest research. She hopes to make facsimile editions of the music theory codices available for the first time.

Dr. Alma Santosuosso is using mediaeval music theory as a historical research tool.

funding profile

Social Sciences and Humanities Research Council	$21,000

Wilfrid Laurier University

Building the World's First Optical Memory Chip

Shaowen Song, Associate Professor in Physics and Computer Science, wants every household to have broadband Internet, and he's designing a chip to make it happen. His research with the world's first optical memory chip—an innovation that uses light signals instead of electrical signals—is breaking new technological ground.

Current technology converts light to electricity for processing, and then converts it back to optics for further transmission. Devices with Dr. Song's optical memory chip would have the capacity to manipulate optical signals directly—a significant advantage.

"This would be one step better than what we have at home now and would mean higher capacities for the network at a lower cost," says Dr. Song.

Since light travels without producing heat, replacing the electronic switches of today's communications networks with the optical memory chip would increase speed and reduce power consumption.

The optical memory chip could facilitate the integration of broadband communications and spur the development of the first optical computer—a faster and smaller supercomputer.

"In the future, communications and computers will have the potential to be all optical," says Dr. Song. "Then, we will move beyond electricity."

Dr. Shaowen Song's research into the optical memory chip may lead to a faster and cheaper Internet.

funding profile

Natural Sciences and Engineering Research Council	$48,000

UNIVERSITY OF
WINDSOR

Visual Artist Explores Fine Art as Research

Lisa Lipton enrolled in the University of Windsor Master of Fine Arts program in Visual Arts because of its flexibility—a perfect fit for her versatile skills in painting, drawing, video, sculpture and installation. While some of her work is figurative, with clearly understood realities, other pieces are more abstract, with often a "tension developing between the two."

It's not often someone thinks of fine art as research, but, "if you strive to conceptualize your work, research—pulling from various theoretical writings—remains a must," says Lisa.

What inspires a theme—melancholy, joy, the macabre, the spiritual? What are the intellectual theories behind art? In Lisa's case, they are the ethereal world of the uncanny and the familiar/unfamiliar occurrence."

In one of her installations, she plays off elements of the real and unreal—how an image representing, say, a person could have a dualistic or ghost-like quality and merge into nothingness.

Lisa has also researched the uncanny in relation to space and time in video. Here, images can be shot in real time or edited to make them seem real when they're not.

In her recent video *If Into Strings* that shows a snowy park, two characters are edited in such a way that they appear transparent. "The characters spin in a ghostly manner," she says. "So in a way they are existing in another reality other than the static park represented on the screen."

funding profile

Natural Sciences and Engineering Research Council	$17,500

UNIVERSITY OF
WINDSOR

Running Injuries Investigated

Maybe there is some truth to the legend of Achilles and his famous heel after all. According to University of Windsor kinesiology graduate student Adriana Holmes, the lower leg plays a more important role in our physical well-being than most people realize.

Specifically, Adriana is researching the forces that a heel impacting a solid surface sends up the leg, particularly the tibialis anterior (in the front) and gastrocnemius (in the back) shank muscles. "That's where a lot of injuries start," she says. The research will focus on how the activation of those two muscles reduces the force's severity.

Adriana's research could be used to design better biomechanical models to understand the impact of forces during athletic activity. "The ultimate goal is to try to reduce injuries during running," she says.

It also has application for future upper-limb study to understand how forces generated by impacts from falls, for example, affect the muscular system. And it could show how men and women react differently to these falls. For Adriana, who is fascinated by how the human body works and responds to the forces of the outside world, this embracing approach is what hooked her.

"This is what I want to do," says Adriana, who is planning an academic career in kinesiology.

▼ Graduate student Adriana Holmes wants her research to reduce running injuries.

funding profile

◗ Natural Sciences and Engineering Research Council	$17,300
◗ Ontario Graduate Scholarship	$15,000

UNIVERSITY OF
WINDSOR

Postdoctoral student Jason Masuda is focusing his chemistry research on a new class of molecules.

New Class of Molecules Means Less Waste, Cheaper Drugs

Jason Masuda's chemistry research may bring relief to the high cost of prescription drugs.

The University of Windsor chemistry grad, now a postdoctoral fellow at the University of California, Riverside, is part of an international team of researchers working with a new class of carbenes, or molecules with unusual carbon atoms. The cyclic alkyl amino carbenes (CAACs) attach themselves to metals to form catalysts for chemical transformations that are more efficient than ever. Unlike other catalysts that need strong heating to become effective, CAAC-based catalysts can be used at room temperature and in small amounts. These new carbenes protect the metals they bind to, making them more stable and longer lasting.

Jason plans to look at how CAACs attach themselves to copper—a cheap material—and other metals.

Because pharmaceutical companies use more carbene-supported catalysts for their chemical reactions, Jason says this could mean cheaper drugs through more efficient manufacturing. This, in turn, would benefit the environment through less waste.

Windsor's chemistry program encourages students to pursue their ideas and research "in directions they wouldn't have taken in the beginning," says Jason.

He adds that, while his own ideas and enthusiasm fuelled his research experience, he also benefitted from access to top-notch equipment and working alongside researchers such as Windsor's Prof. Doug Stephan.

funding profile

Natural Sciences and Engineering Research Council	$40,000
Ontario Graduate Scholarship	$15,000

UNIVERSITY OF
WINDSOR

In Pursuit of Ultra Memory

Majid Ahmadi can barely contain his excitement when talking about star PhD student and researcher Mitra Mirhassani.

An electrical and computer engineering student, Mitra is working on two major projects that promise to bring new innovation to computer applications.

Her research into artificial neural networks combines the best of both digital and analog worlds. This new computer hybrid offers new pattern recognition capabilities that range from document processing and verifying signatures to determining the paint quality used in automobiles.

Mitra is also developing new number systems for computers. This research, in particular, is unique, says Dr. Ahmadi. "Nobody has used it, nobody even knows what type of properties this number system possesses."

The new system would deliver extremely condensed memory units with the ability to store large volumes of data and respond quickly to hardware or software faults. Researchers hope to develop ultra memory from this new system.

"This area is going to be explosive the minute we have those circuits built and are ready to show that, look, there is a new paradigm for designing memories. So we are hoping to deliver that punch at the end of this research."

Mitra credits much of her success to the university's state-of-the-art $30-million Research Centre for Integrated Microsystems and Windsor's collaborative approach between colleagues and professors.

PhD student Mitra Mirhassani is researching artificial neuron networks.

funding profile

- **Networks of Centres of Excellence (Micronet), Natural Sciences and Engineering Research Council and Industry (annually since 1997)** $250,000

MITRA MIRHASSANI

- **Natural Sciences and Engineering Research Council Postgraduate Scholarship (Doctoral)** $42,000

UNIVERSITY OF
WINDSOR

Connecting with Community

No university researcher should be an island, especially when it comes to sexual behaviour and health among youth, says Eleanor Maticka-Tyndale.

The University of Windsor sociologist researches sexuality and sexual behaviours within social and cultural contexts. She has undertaken HIV/AIDS-related research in Kenya and Nigeria, consultation work in Uruguay, and studies in Sweden, France, Great Britain, the U.S. and Canada.

But it is the relatively special Windsor-Essex County Adolescent Sexual Health Programme that continues to strengthen the university-community connection and has opened up opportunities for PhD student Lisa Smylie.

The program brings together professionals from local agencies to promote responsible and healthy decision-making in sexual health by Grade 9 students. Lisa is evaluating the program, which is funded as a doctoral fellowship through Dr. Maticka-Tyndale's **Canada Research Chair** in Social Justice and Sexual Health.

Halfway into her two-year evaluation, Lisa finds the program has resulted in significant gains among students' knowledge and attitudes. Increasingly, teens see men and women as equals, feel more in control of their own sexuality and view birth control as important. They also find it difficult to talk about sex with peers and parents. Lisa feels the program will need work to influence teen attitudes on specific types of birth control.

"It also ties in with my own research as well," adds Lisa. She intends to focus her dissertation on adolescent sexual behaviour and the influence of "social capital—the ability of communities to come together to solve problems [and] what influence that has on their sexual behaviour."

In 2005, Lisa organized the university's first-ever interdisciplinary student conference on social justice issues. It attracted more than 60 students and faculty and featured keynote speaker Dr. Walter DeKeseredy, the American Society for Criminology's Distinguished Scholar of the year in 2004.

▼ Graduate student Lisa Smylie is researching teen attitudes toward sexual health.

funding profile

- Canada Research Chair — $1.4 million
- Social Sciences and Humanities Research Council — $85,583
  —(with Jacqueline Lewis of the University of Windsor and Frances Shaver of Concordia University) — $352,424
- Foreign Governments
  —U.K. — $600,000
  —U.S. — $120,000

LISA SMYLIE
- Social Sciences and Humanities Research Council Doctoral Fellowship — $40,000

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Opening up Blood Platelets Research Possibilities

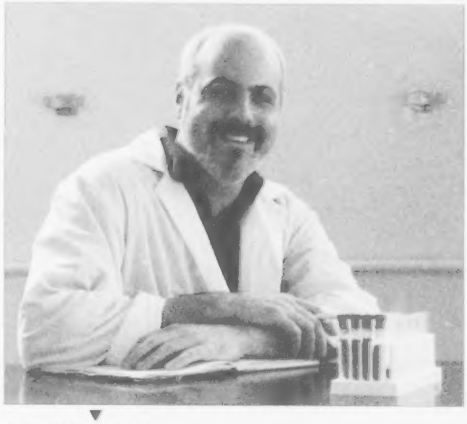
University of Windsor biochemistry researchers are poised to publish research that could have a major impact on the lives of diabetics and those with cardiovascular disease.

Third-year PhD student Shane Miersch, working with Bulent Mutus of the Chemistry and Biochemistry Department, is conducting two research studies. The first examines why platelets in diabetics become hyperactive then "burr-like and sticky," leading to thrombosis or formation of blood clots. Specifically, he's researching one cell-surface enzyme—the protein disulfide isomerase—to see if it can explain why those platelets become hyperactive. Dr. Mutus hopes to publish this research in the prestigious *Journal of Biological Chemistry*.

Shane's second project involves cholesterol. In addition to forming plaque along blood vessel walls, cholesterol can significantly alter how much nitric oxide diffuses through cell membranes. Nitric oxide is particularly important for vasodilating cells—a life-saving function for people with angina, as well as diabetics and those with high blood pressure. As part of his research, Shane is studying whether statins are effective in decreasing the cholesterol and restoring the membrane back to normal. He hopes to publish his findings by spring.

These two studies are the latest in a long line of far-reaching health research projects undertaken by Dr. Mutus, including work on developing a synthetic blood product in the 1990s. He heads the university's Health Research Group, a multidisciplinary collaboration of researchers, and holds a University of Windsor Research Leadership Chair. He is also the university's representative with the **Canadian Institutes of Health Research**.

Dr. Mutus is currently co-ordinating a $10-million grant application to develop a Centre for Nitric Oxide Signalling. Based on Windsor's campus, the proposal centre would include university labs from Ontario to Quebec and solidify the university's growing reputation in nitric oxide research.



PhD student Shane Miersch is studying blood platelets and their relationship to clotting and cholesterol.

funding profile

- Natural Sciences and Engineering Research Council $287,500
- Canadian Institutes of Health Research $73,060
- Canada Foundation for Innovation $700,694
- Ontario Innovation Trust $700,694
- Canadian Diabetes Association $74,959
- AstraZeneca $139,000
- University of Windsor Research Leadership Chair $200,000

SHANE MIERSCH
- Ontario Graduate Scholarship $30,000

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Exploring the Artistic Potential of Augmented Reality

Caitlin Fisher, a **Canada Research Chair** in Digital Culture at York University, is focusing her research on augmented reality (AR), a new technology that merges computer-generated simulations with the real world. While AR has been used in industry for some time, it's a new creative frontier for the artistic and entertainment communities. For example, a person with special AR goggles could walk through a museum and enjoy an interactive visual narrative with the exhibits.

An artist as well as a scholar, Prof. Fisher is working with Distinguished Research Prof. Jay David Bolter from the Georgia Institute of Technology to develop her own AR narratives. "It's exciting. By exploring this new medium we're essentially helping to create it."

Georgia Tech researchers have developed user-friendly software that enables individuals without a programming background to create personal AR projects. As a result, artists and scholars are able to produce their own augmented realities and, in the process, expand the vocabulary of artistic and dramatic conventions for the medium.

Prof. Fisher looks forward to new collaborations that will likely result when she and other Fine Arts researchers move into the third floor of York's new Accolade building and through the development of culture and entertainment research as a strategic priority for the university.

"Collaboration is about more than just working on a single project with someone," she observes. "It's also about building and sharing creative spaces, being able to bounce ideas off colleagues across the hall."

Prof. Caitlin Fisher's hypermedia novella, *These Waves of Girls*, won the 2001 International Electronic Literature Award for Fiction.

funding profile

New Media Collaboration Centre

- Social Sciences and Humanities Research Council $92,744
- Canada Foundation for Innovation $264,379
- Ontario Research Fund —Research Infrastructure $264,379

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Mass Spectrometry May Improve Cancer Diagnosis

Endometrial cancer, which affects the lining of the uterus, is the fourth most common form of cancer facing women in Canada. Last year alone, an estimated 3,500 new cases were reported. While these numbers are alarming, Michael Siu, Director of the Centre for Research in Mass Spectrometry at York University, and his collaborators are taking steps to help improve the diagnosis and prognosis of this potentially deadly condition.

"Traditional methods of cancer diagnosis are not perfect," says Prof. Siu, referring to ultrasound and the painstaking examination of tissue under microscope. "These methods can be very costly and invasive. But mass spectrometry may be able to change all of that."

Mass spectrometry is an analytical technique used to identify the chemical constitution of a substance by separating and weighing that substance's gaseous ions. Prof. Siu is using this methodology to help sequence and identify specific proteins associated with endometrial cancer. These cancer markers, once identified, will greatly improve the diagnosis and even prognosis of cancer.

"Ultimately, we hope to develop a panel or collection of cancer markers," explains Prof. Siu. "This reference group will increase the sensitivity and the selectivity of the diagnosis."

As **Natural Sciences and Engineering Research Council/MDS Sciex Chair,** Prof. Siu stresses the importance of collaboration with academics, hospitals and industry. His current work involves collaborations with researchers in Toronto, Chicago, Halifax and Connecticut, and he expects that his partnerships will continue to expand.

Prof. Michael Siu believes that mass spectrometry may lead to faster and more specific cancer diagnoses.

funding profile

- Natural Sciences and Engineering Research Council (NSERC) (2004-09) $334,680
- NSERC/MDS Sciex/York University (2003-08) $2,539,400
- NSERC/Eli Lilly Canada/Ionalytics (2005-08) $513,525
- Genome Canada (2002-05) $239,750
- National Cancer Institute of Canada
  - —2002-05 $428,548
  - —2005-10 $744,585
- Ontario Research and Development Challenge Fund (2002-06) $1,751,664

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Antarctic Seals Could Help Human Hearts

If you ever find yourself on the ice floes of Antarctica, York University Prof. Thomas Hawke has some advice: watch out for Crabeater seals; they're fast.

"If you get close to them, they will chase you," says Prof. Hawke, a stem-cell biologist who recently returned from a nine-week research trip to Antarctica's McMurdo Research Station.

As the only Canadian member of the four-person team, Prof. Hawke was making his first trip to the deep, cold southern polar region to study the more docile Weddell seals and their amazing ability to dive underwater for long stretches without coming up for air. The seals are the focus of a study by researchers from the University of Texas Southwestern Medical Center at Dallas who asked Prof. Hawke to join them because of his expertise in molecular biology and his work on muscle stem cells. By studying the Weddell seals' deep-diving abilities, Prof. Hawke hopes to learn more about how stem cells work and how that knowledge can help doctors develop new therapies for heart patients.

"If we can replicate the oxygen-transfer capabilities of the Weddell seals' skeletal muscle cells, it is likely we can develop therapies for treating people with cardiovascular or ischemic disease, to give their systems a better chance to rebuild damaged areas after a heart attack or stroke," says Prof. Hawke, who has returned to teaching classes and supervising graduate students at York.

"York graduate students will play an integral role in studying the tissue samples collected in Antarctica," he adds.

Prof. Thomas Hawke is studying deep-diving seals to learn more about stems cells.

funding profile

Natural Sciences and Engineering Research Council	$31,000
Canada Foundation for Innovation	$212,865
Ontario Research Fund —Research Infrastructure	$212,865
The SickKids Foundation, National Grants Program	$65,000

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Prof. Susan McGrath hopes her research into contemporary refugee issues will change public attitudes and public policy.

York Researcher Wants to Change Our Understanding of Refugees

Since 9/11, the movement of refugees across the global landscape has become an increasingly important issue to many countries. As negative perceptions of refugees increase, North American borders have tightened, slowing the flow of refugees. It's an alarming trend that has had a harsh impact on the lives of people trying to flee persecution, war-torn countries and worse. It's also a trend that York University Prof. Susan McGrath is trying to change.

Director of the Centre for Refugee Studies at York, Prof. McGrath is leading a major collaborative and interdisciplinary research project called The Refugee Research Cluster. The project pulls together researchers from across Canada to explore refugee issues and examine our perceptions—and misconceptions—of refugees.

"For example, many women refugees who have lost their husbands in wars have real difficulty finding work," says Prof. McGrath. "They come from agrarian societies and their skills in farming and in running a market stall are not readily transferable in urban settings. Their children have had school disruptions and are often traumatized by the violence. If we don't understand facts like this, we can't possibly understand these refugees."

Ultimately, Prof. McGrath hopes that her research cluster will not only change the way we think about refugees but also contribute to the development of public policy that will improve lives by creating faster and fairer processes of determination while providing increased assistance for settlement and integration.

"We're really looking forward to building on Canada's strengths in refugee protection and humanitarian aid," says Prof. McGrath. "We're also grateful for our graduate students who are helping to realize these goals."

funding profile

Social Sciences and Humanities Research Council	$25,000

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Adopting Muslim Identities

According to the UN, a staggering 98 million migrants will leave their countries between 2005 and 2050. Nearly a tenth will find their way to Canada—approximately 200,000 individuals annually, many of whom will be Muslims. But as Western governments increasingly favour policies of forced integration, tightening immigration and border control—while yielding to conservative Muslims pressing for the Islamification of legal and social life—it is arguable that both multiculturalism and assimilation are failing in Europe and Canada. However, York Prof. Haideh Moghissi, co-investigator with Prof. Saeed Rahnema on *Muslim Diaspora: Heightened Islamic Identity, Gender and Cultural Resistance*, is working to understand this phenomenon and find new solutions.

Drawing together leading scholars from Canada, Britain, France, Sweden and the Netherlands, Prof. Moghissi's collaborative project will explore factors that cause some migrants to suddenly adopt or exaggerate Muslim identities, resisting integration into their host societies.

"Muslim migrants to Western countries face many challenges," notes Prof. Moghissi, editor of the recently published *The Muslim Diaspora: Gender, Culture and Identity* (Routledge, 2006). "Many feel isolated by racism and discrimination, and many are angered by the West's aggressive interventions in the Middle East. In response, Muslims, especially men, can become participants in the invention of a distorted 'Islam' which is then presented back to them as their identity."

Prof. Moghissi, however, cautions against over-generalization."Research show remarkable variance in how Muslims respond to social pressures, racism, and cultural and economic exclusions."

Ultimately, she emphasizes the importance of York University in facilitating her project. "Because of its diverse graduate student population," claims Prof. Moghissi, "York presents an ideal environment for international collaborations.

Prof.Haideh Moghissi is studying why some migrants to Canada suddenly adopt or exaggerate their Muslim identities.

funding profile

Ford Foundation (2006-2008)	$402,000

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Prof. Andrew White is researching new ways to control and manipulate viruses.

York Viral Biochemist Aims to Shoot More Than the Messenger

"Defeating some of the world's most destructive and deadly viruses will require us giving their genetic complexity a lot more respect," says York Professor Andrew White, a viral biochemist and Canada Research Chair in Plant Biotechnology and Structural Biology. Recently awarded a Steacie Fellowship by the Natural Sciences and Engineering Research Council, Prof. White has identified new types of ribonucleic acid (RNA) gates and bridges—termed riboregulators—that function through different structural conformations to control virus replication and gene expression.

Traditionally, RNA has been viewed as DNA's handmaiden, a passive messenger carrying instructions from the nucleus to the cellular machinery that produces proteins. Biologists have viewed RNA viruses in the same way, believing that viral proteins are really calling the shots. Not so, says Prof. White. RNA is far more active in control than previously imagined. In fact, the viral genome is actually a collection of intelligent RNA sub-units, responsible for regulating itself and other molecules.

"What's now clear," says Prof. White, "is that through various interactions or by changing shape, RNA elements actively regulate key steps in viral infections. They are the real conductors of the viral orchestra."

With the help of York undergraduate and graduate students—"an invaluable resource," says Prof. White—the biochemist holds the ultimate goal of gaining control over riboregulators and putting them to work in biotechnology.

"Instead of having viruses hijack our cellular machinery to their ends," says Prof. White, "the goal is to manipulate and control riboregulators so that certain viral processes can be refocused to beneficial applications."

funding profile

◗ Canada Research Chair	$500,000
◗ Natural Sciences and Engineering Research Council	$81,500
◗ Canada Foundation for Innovation	$216,287
◗ Ontario Research Fund —Research Infrastructure	$216,287

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